SOIL SURVEY OF

LUBBOCK COUNTY TEXAS

United States Department of Agriculture
Soil Conservation Service

in cooperation with
Texas Agricultural Experiment Station

How To Use This Soil Survey

General Soil Map

The general soil map, which is a color map, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

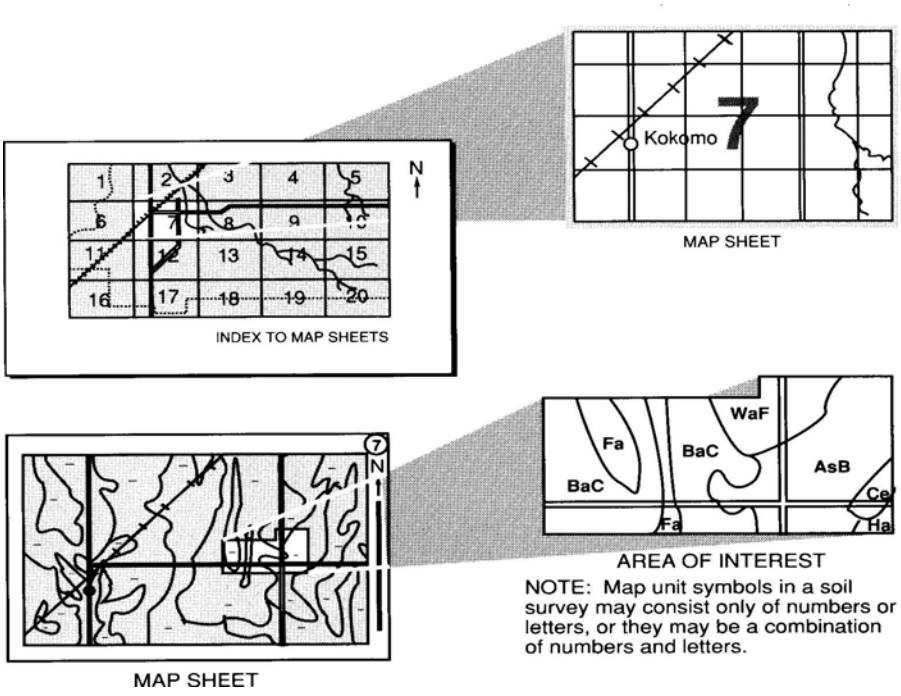
Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**. Click the mouse on the number of the map sheet, the link will take you to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Go to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.



This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1969-75. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1975. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Lubbock County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Bench level borders conserve rainfall and irrigation water. The soil is Acuff loam, 0 to 1 percent slopes.

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Issued April 1979

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Foreword

The Soil Survey of Lubbock County contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

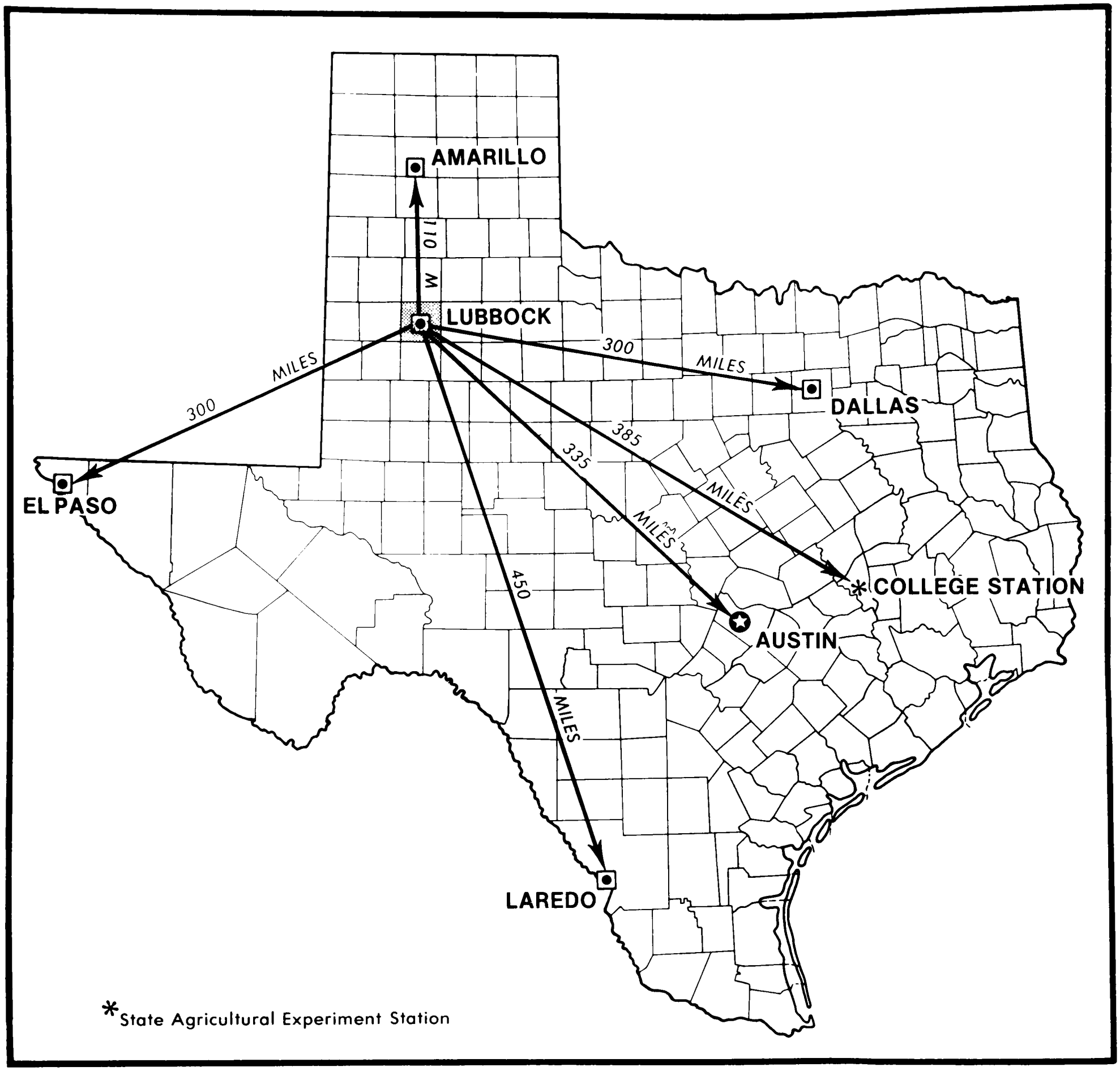
This soil survey has been prepared for many different users. Farmers, ranchers, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

George C. Marks
State Conservationist
Soil Conservation Service



Location of Lubbock County in Texas.

SOIL SURVEY OF LUBBOCK COUNTY, TEXAS

By Dan A. Blackstock, Soil Conservation Service

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United States Department of Agriculture, Soil Conservation Service,
in cooperation with Texas Agricultural Experiment Station

LUBBOCK COUNTY is in the center of the South Plains part of the Southern High Plains (see map on facing page). The total area of the county is 893 square miles, or 571,520 acres.

Most of the county is a nearly level to gently undulating plain, interrupted by numerous enclosed depressions. At the bottoms of depressions are playa lakes. The two small streams in the northwestern part of the county converge in the city of Lubbock and become the North Fork Double Mountain Fork of the Brazos River. The river dissects the plain in an east-southeasterly direction from Lubbock. The surrounding area is generally steep. The elevation rises from 2,900 feet in the southeastern part to 3,400 feet above sea level in the northwest corner.

Lubbock is a farming county. About 83 percent is cropland and 3 percent is range. Cotton and grain sorghum are the main crops. Raising beef cattle is the main ranching enterprise.

The soils formed under grass vegetation. They range from loamy to clayey and from light colored to dark colored. Unprotected areas are subject to soil blowing and water erosion.

General nature of the county

The paragraphs that follow were prepared for those who want general information about Lubbock County. They discuss the settlement and population, the climate, the farming and ranching, and the natural resources.

Settlement and population

Lubbock County, created in 1876 and organized in 1891, was named for Colonel Tom S. Lubbock.

Lubbock, the county seat, in the center of the county, has a population of about 180,000. Other towns in the county include Abernathy, Acuff, Carlisle, Idalou, New Deal, Reese Village, Shallowater, Slaton, Wolfforth, and Woodrow.

Climate

Lubbock County has a dry steppe climate with mild winters. Mean annual precipitation is 18.3 inches. Most of the rainfall occurs during the warm season, April through October. Monthly and annual amounts are extremely variable. The lowest rainfall amount on record was 8.7 inches in 1917, and the highest amount was 40.5 inches in 1941.

Warm season rainfall occurs most frequently as the result of thunderstorms. In exceptionally wet years, a significant proportion of the total may result from excessive downpour that runs off rapidly and erodes the soil.

The prevailing winds are southwesterly November through April and southerly May through October. Windspeeds average about 13 miles per hour. At noon, Central Standard Time, the mean relative humidity is estimated at 50 percent in January, 42 percent in April, 45 percent in July, and 46 percent in October. In winter, Lubbock County receives about 67 percent of the total possible sunshine. In summer, it receives about 78 percent. The mean annual free water (lake) evaporation is 69 inches.

In *winter* cold Polar Canadian air masses sweeping southward across the Great Plains bring sharp drops in temperature in the Lubbock area. Sometimes these air mass changes are accompanied by strong northerly winds. Cold spells rarely last longer than 48 hours before sunshine and southwesterly winds bring rapid warming. Nights are usually clear and cold. Freezing temperature occurs almost every night. Most days are sunny and mild. The lowest temperature on record in Lubbock County is —17 degrees F. Winter is a dry season. Precipitation often falls in the form of light snow that piles up in drifts. Snowmelt, therefore, is not uniformly distributed.

Spring offers the greatest variety in weather. Warm and cold spells follow each other in rapid succession throughout March and April. Trees and shrubs may bloom too early and be nipped by a late freeze. March and April are the windiest months of the year. Occasionally, the persistently strong southwesterly to northwesterly winds cause blowing dust in the area. Thunderstorms rarely occur in winter but increase in number in spring and

reach a peak in May and June. In an average year, May and June are the wettest months.

Summer is one of the most pleasant seasons in Lubbock County. Afternoon temperatures are sometimes hot, but most nights are pleasantly cool. Cloudiness or precipitation during the day causes a significant drop in temperature. Evaporative-type air conditioners operate efficiently in this relatively dry climate. The highest temperature on record at Lubbock is 109 degrees.

Fall, like the summer season, is very pleasant in Lubbock County. There is a greater variety in the weather than in summer, but temperatures are moderate. Rainfall increases slightly early in fall and then decreases quite sharply in November. Mild sunny days and clear cool nights characterize the fall season. Winds are not so strong as in the spring.

The warm season, or freeze free period, in Lubbock County averages 211 days. The mean dates of the last 32 degree temperature or below in spring and the first in fall are April 7 and November 4, respectively.

Farming and ranching

The main agricultural enterprises in Lubbock County are nonirrigated and irrigated farming, ranching, and large feedlot operations.

Cotton and grain sorghum are grown on medium-sized to large, fully mechanized farms. Other crops frequently grown are wheat, soybeans, and sunflowers. Some farms have small areas of grass and raise a few livestock.

Cattle ranching is the major enterprise on the steep soils along the North Fork Double Mountain Fork of the Brazos River. Livestock operations are mainly cow-calf. Supplemental feeding is usually heavy.

There are several large cattle feedlots in the county, as well as feedlots for swine.

Natural resources

Soil is the most important natural resource in Lubbock County. Food and fiber for market and home consumption, as well as forage for livestock, are the major sources of income.

The oil and gas produced in some parts of the county provide income for some landowners.

Water is another natural resource. Irrigation wells have provided supplemental irrigation water for crops in all parts of the county.

Caliche, used mainly in local road construction, is mined commercially in some parts of the county.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from State and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

The general soil map at the back of this publication shows, in color, map units that have a distinct pattern of soils and of relief and drainage. Each map unit is a unique

natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The soils in the survey area vary widely in their potential for major land uses. Table 1 shows the extent of the map units shown on the general soil map and gives general ratings of the potential of each, in relation to the other map units, for major land uses. Soil properties that pose limitations to the use are indicated. The ratings of soil potential are based on the assumption that practices in common use in the survey area are being used to overcome soil limitations. These ratings reflect the ease of overcoming the soil limitations and the probability of soil problems persisting after such practices are used.

Each map unit is rated for *cultivated farm crops, range, urban uses,* and *recreation areas.* Cultivated farm crops are those grown extensively by farmers in the survey area. Range refers to land in native range plants. Urban uses include residential, commercial, and industrial developments. Recreation areas include campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic and those used for nature study and as wilderness.

The five map units in Lubbock County are described in the paragraphs that follow.

1. Amarillo-Acuff

Deep, nearly level to gently sloping, moderately permeable loamy soils on uplands

Areas of these well drained soils are mostly in the southern part of the county.

This map unit makes up about 62 percent of the county. It is about 31 percent Amarillo soils, 28 percent Acuff soils, and 41 percent other soils (fig. 1).

Amarillo soils have slopes of 0 to 3 percent. The surface layer is friable, mildly alkaline, reddish brown fine sandy loam about 14 inches thick. From 14 to 46 inches is friable, reddish brown sandy clay loam that is mildly alkaline in the upper 10 inches and moderately alkaline in the lower 22 inches. From 46 to 60 inches is friable, moderately alkaline, pink sandy clay loam that is about 30 percent soft masses and weakly cemented concretions of calcium carbonate. From 60 to 80 inches is friable, moderately alkaline, pink sandy clay loam that has many soft masses and weakly cemented concretions of calcium carbonate.

Acuff soils have slopes of 0 to 3 percent. The surface layer is friable, neutral, brown loam about 12 inches thick. From 12 to 38 inches is friable sandy clay loam that is reddish brown and mildly alkaline in the upper 16 inches and yellowish red and moderately alkaline in the lower 10 inches. From 38 to 58 inches is friable, moderately alkaline, pink sandy clay loam that is about 40 percent soft masses and concretions of calcium carbonate. From 58 to 80 inches is friable, moderately alkaline, sandy clay loam that is reddish yellow and has common films and threads of calcium carbonate.

Other soils are Drake, Estacado, Lofton, Mansker, Olton, and Randall. Drake, Estacado, Mansker, and Olton soils are well drained, and Lofton soils are moderately well drained. All are on side slopes above playas. Randall soils, which are somewhat poorly drained, are on the floors of playas.

This unit is used mainly for cultivated crops. Much of the acreage is irrigated. There are a few small pastures of tame and native grasses. Some areas are covered with urban works and structures, both residential and commercial.

This unit has high potential for cultivated crops, especially if irrigated. Rainfall is adequate in most years for moderate to good yields of the main crops, which are cotton, grain sorghum, and soybeans.

The potential is high for range. Yields of short and mid grasses are good in favorable years.

The soils have high potential for most urban use. They have moderate potential for sewage lagoons because the seepage rate is so rapid. The potential is only medium for local streets and roads because of the low strength of the soil material. The potential is high for recreational uses.

2. Olton-Acuff

Deep, nearly level to gently sloping, moderately slowly permeable and moderately permeable loamy soils on uplands

Areas of these well drained soils are mostly in the northern part of the county.

This map unit makes up about 16 percent of the county. It is about 60 percent Olton soils, 25 percent Acuff soils, and 15 percent other soils.

Olton soils have slopes of 0 to 3 percent. The surface layer is friable, mildly alkaline, brown clay loam about 10 inches thick. From 10 to 30 inches is firm clay loam that is brown and mildly alkaline in the upper 8 inches and reddish brown and moderately alkaline in the lower 12 inches. From 30 to 42 inches is firm, moderately alkaline, reddish brown clay loam that has a few films and threads of calcium carbonate. From 42 to 60 inches is friable, moderately alkaline, pink clay loam that is about 40 per-

cent soft masses and concretions of calcium carbonate. From 60 to 80 inches is friable, moderately alkaline, yellowish red clay loam that is about 25 percent soft masses and concretions of calcium carbonate.

The nearly level to gently sloping Acuff soils are on the uplands. Slopes are 0 to 3 percent. The surface layer is friable, neutral, brown loam about 12 inches thick. From 12 to 38 inches is friable sandy clay loam that is reddish brown and mildly alkaline in the upper 16 inches and yellowish red and moderately alkaline in the lower 10 inches. From 38 to 58 inches is friable, moderately alkaline, pink sandy clay loam that is about 40 percent soft masses and concretions of calcium carbonate. From 58 to 80 inches is friable, moderately alkaline sandy clay loam that is reddish yellow and has common films and threads of calcium carbonate.

Other soils are Arch, Drake, Estacado, Lofton, Randall, and Zita. Arch, Drake, Estacado, and Zita soils are well drained. Arch, Zita, and Lofton soils are on benches above playas. Drake and Estacado soils are on side slopes above playas. Lofton soils are moderately well drained. Randall soils are somewhat poorly drained. They occupy the floor of playas.

This unit is used mainly for cultivated crops. Range is limited to small plots. There is very little urban development.

The potential is high for cultivated crops. Much of the area is irrigated, but rainfall is adequate in most years for moderate to good yields of dryland crops.

The potential is medium for range. The soils are droughty. Yields of short grasses are fair to good, however, in favorable years.

The potential is medium for urban development. Olton soils are only moderately well suited to septic tank absorption fields because effluent percolates slowly through the clayey soil material. The potential is only medium for local streets and roads because of the low strength of the soil material. The potential is also only medium for recreational development because the soils are too clayey and percolation of water is too slow.

3. Pullman-Olton

Deep, nearly level to gently sloping, very slowly permeable and moderately slowly permeable loamy soils on uplands

Areas of these well drained soils are mostly in the northeastern part of the county.

This map unit makes up about 15 percent of the county. It is about 56 percent Pullman soils, 25 percent Olton soils, and 19 percent other soils (fig. 2).

The nearly level Pullman soils are on uplands. Slopes are 1 percent or less. The surface layer is brown, friable, mildly alkaline clay loam about 12 inches thick. From 12 to 46 inches is firm, moderately alkaline clay that is brown in the upper 22 inches and reddish brown in the lower 12 inches. From 46 to 66 inches is friable, moderately alkaline, pink clay that is about 30 percent soft masses and concretions of calcium carbonate. From 66 to 80 inches is friable, moderately alkaline, reddish yellow clay that is about 15 percent soft masses and concretions of calcium carbonate.

The nearly level to gently sloping Olton soils are on uplands. Slopes are 0 to 3 percent. The surface layer is friable, mildly alkaline, brown clay loam about 10 inches thick. From 10 to 30 inches is firm clay loam that is brown and mildly alkaline in the upper 8 inches and is reddish brown and moderately alkaline in the lower 12 inches. From 30 to 42 inches is firm, moderately alkaline, reddish brown clay loam that has a few films and threads of calcium carbonate. From 42 to 60 inches is friable, moderately alkaline, pink clay loam that is about 40 percent soft masses and concretions of calcium carbonate. Below this to a depth of 80 inches is friable, moderately alkaline, yellowish red clay loam that is about 25 percent soft masses and concretions of calcium carbonate.

Other soils are Drake, Randall, and Zita. Drake and Zita soils are well drained. Randall soils, which are in playas, are somewhat poorly drained. Zita soils occupy benches above Randall soils. Drake soils occupy side slopes that are above playas.

This unit is used mainly for crops. Most of the area is irrigated. Range is limited to a few small pastures. There is no urban development.

The potential is high for crops. The main crops are cotton, grain sorghum, and soybeans.

The potential is only medium for range. The soils are droughty. Yields of short grasses are fair in favorable years.

The potential is low for urban use. The soils are highly corrosive to uncoated steel, have high shrink-swell potential, and have low strength. Special engineering design is needed to overcome these hazards in constructing buildings and streets and roads. The soils have medium potential for recreational use.

4. Potter-Berda-Bippus

Very shallow, shallow, and deep, nearly level to steep, moderately permeable loamy soils on uplands and bottom lands

Areas of these well drained soils are along drainageways and canyons mostly in the southeastern part of the county.

This map unit makes up about 4 percent of the county. It is about 38 percent Potter soils, 28 percent Berda soils, 12 percent Bippus soils, and 22 percent other soils (fig. 3).

The gently sloping to steep Potter soils are on uplands. Slopes are 1 to 45 percent. The surface layer is friable, moderately alkaline, grayish brown loam 5 inches thick. It has a few hard caliche fragments and many concretions of calcium carbonate. From 5 to 12 inches is friable, moderately alkaline, pale brown loam that has common calcium carbonate concretions and caliche fragments. From 12 to 30 inches is soft, fractured, white caliche that is slightly platy in the upper 6 inches.

The gently sloping to steep Berda soils are on foot slopes. Slopes are 1 to 45 percent. The surface layer is friable, moderately alkaline, grayish brown loam about 8 inches thick. From 8 to 20 inches is friable, moderately alkaline, grayish brown loam that has a few films, threads, and concretions of calcium carbonate. From 20 to 28 inches is friable, moderately alkaline, light reddish brown loam that also has a few films, threads, and concretions of calcium carbonate. From 28 to 58 inches is friable, moderately alkaline loam that is light brown in the upper 12 inches and reddish brown in the lower 18 inches. It has a few soft masses and concretions of calcium carbonate.

The nearly level Bippus soils are on frequently flooded bottom lands. Slopes are 0 to 1 percent. The surface layer is very friable, mildly alkaline, dark brown clay loam 30 inches thick. From 30 to 72 inches is very friable, moderately alkaline, brown clay loam that has a few films and threads of calcium carbonate.

Other soils are Mansker, Mobeetie, and Posey. These soils are well drained. The gently sloping to sloping Mansker and Posey soils are on uplands. The gently sloping to steep Mobeetie soils are on foot slopes.

This unit is used mainly as range. A few small areas are under urban development.

This unit is not suited to cultivated crops because of the slope and the frequent flooding.

The potential is high for range. Yields of short and mid grasses are good during favorable years.

The unit has low potential for urban use because of the steep slopes, the hazard of water erosion, and the flood hazard. The potential is high for recreational use. The slope limits the use of some areas as playgrounds.

5. Posey-Mansker-Bippus

Deep, nearly level to sloping, moderately permeable loamy soils on bottom lands and uplands

Areas of these well drained soils are along drainageways in the northwestern part of the county.

This map unit makes up about 3 percent of the county. It is about 40 percent Posey soils, 30 percent Mansker soils, 10 percent Bippus soils, and 20 percent other soils.

The nearly level to sloping Posey soils are on uplands. Slopes range from 0 to 8 percent. The surface layer is friable, moderately alkaline, reddish brown fine sandy loam about 10 inches thick. From 10 to 39 inches is moderately alkaline sandy clay loam that is reddish brown and friable and has a few films, threads, and masses of calcium carbonate in the upper 8 inches. The lower 21 inches is light reddish brown and firm and about 40 percent soft masses and concretions of calcium carbonate. From 39 to 80 inches is firm, moderately alkaline, reddish yellow sandy clay loam that is about 10 percent soft masses and concretions of calcium carbonate.

The gently sloping Mansker soils are on uplands. Slopes range from 1 to 5 percent. The surface layer is friable, moderately alkaline, brown clay loam about 8 inches thick. From 8 to 32 inches is friable, moderately alkaline clay loam. It is light brown and about 35 percent soft masses and concretions of calcium carbonate in the upper 7 inches. It is pink and about 60 percent soft masses and concretions of calcium carbonate in the lower 17 inches. From 32 to 60 inches is friable, moderately alkaline, reddish yellow clay loam that is about 10 percent soft masses and concretions of calcium carbonate.

The nearly level Bippus soils are on bottom lands. Slopes are 0 to 1 percent. The surface layer is very friable, mildly alkaline, dark brown clay loam about 30 inches thick. From about 30 to 72 inches is very friable, moderately alkaline, brown clay loam that has a few films and threads of calcium carbonate.

Other soils are the well drained Acuff, Amarillo, Berda, and Mobeetie. The nearly level to gently sloping Acuff and Amarillo soils are on uplands. The gently sloping to sloping Berda and Mobeetie soils are on foot slopes.

This unit is used for cultivated crops and as range.

The potential is only medium for cultivated crops. The main concerns are susceptibility to water erosion, soil blowing, and slope.

The potential is high for range. Yields of short and mid grasses are good during favorable years.

The potential is only medium for urban use because of slope, low strength of the soil material, and corrosivity to uncoated steel. The potential is also only medium for recreational use because of slope and the clayey texture of the surface layer.

Land use considerations

The map units in Lubbock County vary widely in their potential for major land uses, as indicated in table 1. For each land use, general ratings of the potential of each map unit in relation to the other map units are indicated. Kinds of soil limitations are also indicated in general terms. The ratings of soil potential reflect the relative cost of such practices and also the hazard of continuing soil related problems after such practices are installed. The ratings do not consider location in relation to existing transportation systems or other kinds of facilities.

The kinds of land use considered are cultivated farm crops, range, urban development, and recreation. Cultivated farm crops grown in the survey area include cotton, grain sorghum, wheat, and soybeans. Range refers to land in native range plants. Urban areas are residential, commercial, and industrial sites. Nature study area trails and wilderness areas are examples of land used for recreation.

In general, the declining supply of irrigation water, the low rainfall, the kinds of soil, and the urban growth are the most important factors that influence land use in Lubbock County.

About 83 percent of the county is used for cultivated farm crops, 14 percent is urban, and 3 percent is range. According to table 1, about 93 percent of the county has high potential for cultivated farm crops, 3 percent has medium potential, and 4 percent has low potential. Table

1 also indicates that about 69 percent of the county has high potential for range and 31 percent has medium potential.

Most of the soils that are suitable for cultivated farm crops are used for that purpose. The acreage of land under irrigation is steadily declining along with the steadily decreasing underground supply of irrigation water.

There is a rapid increase in the number of acres under urban development and recreational use and a slight decrease in the number of acres of range.

In general, the Amarillo-Acuff, Olton-Acuff, and Pullman-Olton units have high potential for cultivated farm crops. These deep loamy soils are well suited to cultivated crops. Good management is needed, however, to prevent water erosion and soil blowing.

The Amarillo-Acuff, Potter-Berda-Bippus, and Posey-Mansker-Bippus units have high potential for range. These deep loamy soils require careful management to prevent water erosion and soil blowing.

The Amarillo-Acuff unit has high potential for urban and recreational uses. The main problems are the seepage and the low strength. The Potter-Berda-Bippus unit has high potential for recreational uses. The main problems are the slope and the flood hazard.

The general soil information in this section and more detailed information in the following sections can be used as guides in planning the orderly growth and development of the county. This information is especially helpful in determining what land should be allocated to each use.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have a profile that is almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Acuff loam, 0 to 1 percent slopes, is one of two phases within the Acuff series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes, soil associations, and undifferentiated groups.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Amarillo-Urban land complex, 0 to 2 percent slopes, is an example.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map because it is not practical to separate them. A soil association has considerable regularity in geographic pattern and in the kinds of soil that are a part of it. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for use and management of the soils. Berda-Potter association, hilly, is an example.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Arents and Pits is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 2, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

1—Acuff loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands. It occurs as irregularly shaped areas that range from 10 to more than 1,000 acres.

The surface layer is friable, neutral, brown loam about 12 inches thick. From 12 to 28 inches is friable, reddish brown sandy clay loam that is mildly alkaline in the upper part and moderately alkaline below. From 28 to 33 inches is friable, moderately alkaline, yellowish red sandy clay loam. From 38 to 58 inches is friable, moderately alkaline, pink sandy clay loam that is about 40 percent by volume calcium carbonate. From 58 to 80 inches is friable, moderately alkaline, reddish yellow sandy clay loam that is about 15 percent by volume calcium carbonate.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included in some areas of this soil are small areas of Amarillo, Estacado, and Olton soils. Also included are small areas where Acuff soils have slopes of 1 to 3 percent. Included soils make up less than 10 percent of any one mapped area.

This soil is used as cropland. Cotton and grain sorghum are the main crops, but other crops can be grown.

This soil has high potential for nonirrigated and irrigated cotton, grain sorghum, soybeans, and wheat (fig. 4). Good management includes leaving crop residue on the surface when crops are not growing, using timely and limited tillage, and rotating crops. These practices help to control soil blowing and water erosion and help to conserve moisture. Residue also helps to maintain soil productivity. Occasionally, emergency tillage is needed to roughen the surface and thus reduce the damage caused by soil blowing when crops and residue do not furnish adequate protection. A well designed irrigation system and proper application of irrigation water are essential. Either surface or sprinkler irrigation can be used. If irrigated, this soil needs to be fertilized.

This soil has only medium potential for native range plants because of low available moisture during the growing season. Native range plants are mainly short grasses, which produce a medium amount of forage. The potential is medium for wildlife habitat.

This soil has high potential for most urban and recreational use. It is corrosive to uncoated steel and has low strength, but these limitations can be easily overcome by good design and careful installation.

Capability subclass IIIe nonirrigated, IIe irrigated; Clay Loam range site.

2—Acuff loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands. It occurs as irregularly shaped areas that range from 10 to 100 acres.

The surface layer is friable, mildly alkaline, reddish brown loam 8 inches thick. From 8 to 16 inches is friable, mildly alkaline, reddish brown sandy clay loam. From 16 to 33 inches is friable, mildly alkaline, red sandy clay loam that has a few films and threads of calcium carbonate. From 33 to 55 inches is friable, moderately alkaline, reddish yellow sandy clay loam that is about 20 percent by volume soft masses and concretions of calcium carbonate. From 55 to 80 inches is friable, moderately alkaline, yellowish red sandy clay loam that is about 15 percent by volume calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is moderate. The hazard of soil blowing is slight.

Included in some areas of this soil are spots of Amarillo, Estacado, and Mansker soils. Included soils make up less than 10 percent of any one mapped area.

This soil is used as cropland. Cotton and grain sorghum are the main crops, but other crops can be grown.

The potential is medium for nonirrigated and irrigated cotton, grain sorghum, soybeans, and wheat. Good management includes leaving crop residue on the surface when crops are not growing, using timely and limited tillage, and rotating crops. These practices help to control soil blowing and water erosion and help to conserve moisture. Residue also helps to maintain soil productivity. Occasionally, emergency tillage is needed to roughen the surface and thus reduce the damage caused by soil blowing when crops and residue do not furnish adequate protection. A well designed irrigation system and proper application of irrigation water are essential. Either surface or sprinkler irrigation can be used. If irrigated, this soil needs to be fertilized.

This soil has only medium potential for native range plants because of low available moisture during the growing season. Native range plants are mainly short grasses, which produce a medium amount of forage. The potential is medium for wildlife habitat.

This soil has high potential for most urban and recreational use. It is corrosive to uncoated steel and has low strength, but these limitations can be easily overcome by good design and careful installation.

Capability subclass IIIe nonirrigated, IIIe irrigated; Clay Loam range site.

3—Acuff-Urban land complex, 0 to 2 percent slopes. This nearly level to gently sloping unit is on uplands. It occurs as irregularly shaped areas that range from 15 to more than 1,000 acres.

Acuff soils make up about 55 percent of this unit, Urban land about 35 percent, and other soils 10 percent.

Acuff soils are deep. The surface layer is friable, neutral, brown loam about 12 inches thick. From 12 to 28 inches is friable, mildly alkaline, reddish brown sandy clay loam. From 28 to 38 inches is friable, moderately alkaline, yellowish red sandy clay loam. From 38 to 58 inches is friable, moderately alkaline, pink sandy clay loam that is about 40 percent by volume calcium carbonate. From 58 to 80 inches is friable, moderately alkaline, light reddish brown sandy clay loam that is about 15 percent by volume calcium carbonate.

Urban land consists of residential and commercial buildings, driveways, streets, sidewalks, and parking lots.

Acuff soils are well drained and are high in natural fertility. Surface runoff is high because the works and structures shed most of the precipitation. Permeability is moderate, and available water capacity is high.

Included in mapping are small areas of Amarillo, Estacado, and Olton soils. These inclusions make up less than 10 percent of any one mapped area.

This unit is entirely in urban use. Acuff soils are used for lawn grasses, ornamental trees and shrubs, and flower and vegetable gardens.

The potential is high for most urban and residential use. Acuff soils are corrosive to uncoated steel and have low strength, but these limitations can be easily overcome by good design and careful installation. The potential is high for recreational use.

The potential is low for cropland and rangeland.

4—Amarillo loamy fine sand, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil is on uplands. It occurs as one broad irregularly shaped area of about 660 acres. Local shifting of soil by wind is evident in some places.

The surface layer is very friable, neutral, reddish brown loamy fine sand 12 inches thick. From 12 to 40 inches is friable, red sandy clay loam that is mildly alkaline in the upper 14 inches and moderately alkaline in the lower 14 inches. From 40 to 60 inches is friable, moderately alkaline, red sandy clay loam that has a few films and threads of calcium carbonate. From 60 to 80 inches is friable, moderately alkaline, reddish yellow sandy clay loam that is about 30 percent by volume soft masses and concretions of calcium carbonate.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is slight. The hazard of soil blowing is high.

Included with this soil in mapping are a few small areas that have a fine sandy loam layer below the surface layer. In some areas the layer that is enriched with calcium carbonate is below a depth of 72 inches. Included soils make up less than 10 percent of the mapped area.

This soil is used entirely as cropland. Grain sorghum and cotton are the main crops, but other crops can be grown.

This soil has high potential for nonirrigated and irrigated cotton and medium potential for nonirrigated and irrigated grain sorghum and wheat. Good management includes leaving crop residue on the surface when crops are not growing, using timely and limited tillage, and rotating crops. These practices help to control water erosion and soil blowing and also help to conserve moisture. Residue helps to maintain soil productivity. Occasionally, emergency tillage is needed to roughen the surface and thus reduce the damage caused by soil blowing when crops and residue do not furnish adequate protection. A well designed irrigation system and proper application of irrigation water are essential. Sprinkler irrigation should be used. If irrigated, this soil needs to be fertilized.

This soil has high potential for native plants. In some years forage production is limited because of low available moisture during the growing season. Native plants are mainly short grasses, which produce a good yield of forage. The potential is medium for wildlife habitat.

This soil has high potential for most urban use. Low strength for streets and roads and seepage from sewage lagoons are the most restrictive features. The potential is medium for recreational use. The loamy fine sand surface layer restricts most uses.

Capability subclass IVe nonirrigated, IIIe irrigated; Loamy Sand range site.

5—Amarillo fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands. It occurs as irregularly shaped areas that range from 10 to 200 acres. Local shifting of soil by wind is evident in some places.

The surface layer is friable, mildly alkaline, reddish brown fine sandy loam about 14 inches thick. From 14 to 46 inches is friable, reddish brown sandy clay loam that is mildly alkaline in the upper 10 inches and moderately alkaline in the lower 22 inches. From 46 to 80 inches is friable, moderately alkaline, pink sandy clay loam. The upper part of this layer is about 30 percent by volume soft masses and weakly cemented concretions of calcium carbonate.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Included in some areas of this soil are spots of Acuff, Olton, and Posey soils. Also included are small areas where Amarillo soils have slopes of 1 to 3 percent and areas where they have limy layers that are more than 60 inches deep. Included soils make up less than 15 percent of any one mapped area.

This soil is used as cropland. Cotton and grain sorghum are the main crops, but other crops can be grown.

The potential is high for nonirrigated and irrigated cotton, grain sorghum, and soybeans. Keeping crop residue on or near the surface conserves moisture and helps to control soil blowing and water erosion. Diversion terraces and grassed waterways can be used to control outside runoff. In dry years, emergency tillage is needed to control soil blowing if crop residue does not furnish adequate protection. Fertilizer is needed if the soil is irrigated. A designed irrigation system and proper application of irrigation water are essential. Either surface or sprinkler irrigation can be used.

The potential is high for native range plants. Yields of short and mid grasses are good during favorable years. The potential is medium for wildlife habitat.

This soil has high potential for most urban use. Low strength for streets and roads and seepage from sewage lagoons are the most restrictive features. The potential is high for recreational use.

Capability subclass IIIe nonirrigated, IIe irrigated; Sandy Loam range site.

6—Amarillo fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands. It occurs as irregularly shaped areas that range from 20 to 200 acres. Local shifting of soil by wind is evident in some places.

The surface layer is friable, neutral, reddish brown fine sandy loam about 10 inches thick. From 10 to 32 inches is friable, reddish brown sandy clay loam that is mildly alkaline in the upper 8 inches and moderately alkaline in the lower 14 inches. From 32 to 40 inches is friable, moderately alkaline, yellowish red sandy clay loam. Between 40 and 47 inches is friable, moderately alkaline, reddish yellow sandy clay loam that is about 30 percent by volume soft masses and weakly cemented concretions of calcium carbonate. From 47 to 80 inches is friable, moderately alkaline, reddish yellow sandy clay loam that is about 20 percent by volume calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is high. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included in some areas of this soil are spots of Acuff, Olton, and Posey soils and a soil that is similar to the Amarillo soil but has a layer of calcium carbonate below 60 inches. Included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as cropland, but there are a few small areas of range. Cotton, grain sorghum, and soybeans are the main crops.

The potential is high for nonirrigated and irrigated cotton and soybeans. The potential is medium for nonirrigated and irrigated grain sorghum and wheat. Keeping crop residue on or near the surface helps to control water erosion and soil blowing and to conserve moisture. Contour farming and terraces are needed to help control water erosion. Grassed waterways make good outlets for terrace systems. In dry years, emergency tillage is needed to control soil blowing when crop residue does not furnish adequate protection. A designed irrigation system and proper application of irrigation water are essential. Fertilizer is needed if this soil is irrigated. Sprinkler irrigation is best adapted. If surface irrigation is used, bench leveling is necessary.

The potential is high for native range plants. Low rainfall is the most limiting factor. The potential is medium for wildlife habitat.

This soil has high potential for most urban use. Low strength and seepage are the most restrictive features. The potential is high for recreational use. Slope restricts the use of some areas as playgrounds.

Capability subclass IIIe nonirrigated, IIIe irrigated; Sandy Loam range site.

7—Amarillo-Urban land complex, 0 to 2 percent slopes. This nearly level to gently sloping map unit is on uplands. It occurs as irregularly shaped areas that range from 25 to about 2,000 acres.

Amarillo soils make up about 55 percent of this unit, Urban land about 35 percent, and other soils 10 percent.

The surface layer of the Amarillo soil is friable, mildly alkaline, reddish brown fine sandy loam about 14 inches thick. From 14 to 46 inches is friable, reddish brown sandy clay loam that is mildly alkaline in the upper 10 inches and moderately alkaline in the lower 22 inches. From 46 to 80 inches is friable, moderately alkaline pink sandy clay loam that is about 30 percent by volume soft masses and weakly cemented concretions of calcium carbonate.

Urban land consists of works and structures, most of which are residential and commercial buildings, driveways, sidewalks, and parking lots.

Amarillo soils are well drained. Surface runoff is high because a large percentage of soil is covered by works and structures, which shed most of the precipitation. The root zone is deep and is easily penetrated by roots. The hazard of water erosion is slight. The hazard of soil blowing is moderate. Permeability is moderate, and the available water capacity is high.

Included in mapping are spots of Acuff, Olton, and Estacado soils, which make up less than 10 percent of any one mapped area.

This unit is entirely in urban use. Amarillo soils are used for lawn grasses, ornamental trees and shrubs, and vegetable and flower gardens.

The potential is high for most urban use. Low strength for streets and roads and seepage from sewage lagoons are the most restrictive features. The potential is high for recreational use. The potential is low for cropland and range.

8—Arch loam, 0 to 3 percent slopes. This deep, nearly level to gently sloping soil is on benches around playas. It occurs as long narrow areas that range from 5 to 100 acres.

The surface layer is very friable, moderately alkaline, brown loam about 9 inches thick. From 9 to 17 inches is very friable, moderately alkaline, grayish brown sandy clay loam that has a few films and threads of calcium carbonate. From 17 to 34 inches is friable, moderately alkaline, light brownish gray sandy clay loam that has a few soft masses and concretions of calcium carbonate. From 34 to 47 inches is friable, moderately alkaline, light gray sandy clay loam that has many soft masses and concretions of calcium carbonate. From 47 to 80 inches is very friable, moderately alkaline, very pale brown fine sandy loam that also has many soft masses and concretions of calcium carbonate.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is low. The root zone is deep and is easily penetrated by plant roots. Because of an excess of calcium carbonate, many plants do not grow well in this soil. The hazard of water erosion is slight. The hazard of soil blowing is moderate.

Included in some areas of this soil are spots of Lofton, Portales, and Zita soils. Included soils make up less than 10 percent of any one mapped area.

Most areas of this soil are used as cropland. Grain sorghum and cotton are the main crops.

This soil has low potential for nonirrigated and irrigated grain sorghum and cotton. Good management includes growing crops that produce a large amount of residue, leaving crop residue on the surface when crops are not growing, and using timely and limited tillage. These practices help to control soil blowing and water erosion and help to conserve moisture. Residue also helps to maintain soil productivity. Occasionally, emergency tillage is needed to roughen the surface and thus reduce the damage caused by soil blowing when crops and residue do not give adequate protection. A well designed irrigation system and proper application of irrigation water are essential. Either surface or sprinkler irrigation can be used. If irrigated, this soil needs to be fertilized.

This soil has low potential for native plants. Its potential is limited because of low available moisture during the growing season and excessive amounts of calcium carbonate. Native range plants are mainly short grasses, which produce a small amount of forage. The potential is medium for wildlife habitat.

This soil has medium potential for most urban use. It is highly corrosive to uncoated steel and has low strength and moderate shrink-swell potential in the lower layers. The potential is medium for recreation use. Dust is the most restrictive feature.

Capability subclass IVe nonirrigated, IIIe irrigated; High Lime range site.

9—Arents and Pits. This map unit consists of very shallow to deep soils on uplands. Slopes range from 1 to 12 percent. Areas are square or oblong and range from 10 to 200 acres.

Arents make up about 65 percent of the map unit, Pits about 25 percent, and other soils 10 percent. These soils are not uniform and do not occur in a regular pattern.

Arents have been reshaped and smoothed by heavy machinery. They occur around playas and over abandoned caliche pits and sites of sanitary landfill. Varying soil layers have been mixed to depths of more than 80 inches. The soil material is mainly friable, moderately alkaline, brown, reddish brown, and dark reddish brown sandy clay loam. Throughout the profile are strata of clay loam, pockets of fine sandy loam, caliche fragments up to 1 inch across, and various wood, metal, glass, and plastic fragments.

Arents are well drained. Surface runoff is slow to rapid. Permeability is moderate, and available water capacity is high. The hazards of water erosion and soil blowing are moderate. The root zone is deep and is easily penetrated by plant roots.

Pits are sites that have been excavated during the mining of caliche. They have vertical walls and range from 3 to 25 feet deep. Some are used as sites for sanitary landfill. Some are beginning to revegetate. Most are poorly drained and are ponded for extended periods.

Included in mapping are small areas of Potter, Berda, Randall, Posey, Mansker, Lofton, and Zita soils. Included soils make up less than 15 percent of any one mapped area.

Most areas of this map unit are used for urban development and for recreation. Some are idle. A few are grazed.

This unit is not suited to cultivated crops. The potential is low for native plants. Poor physical condition of the soil and low rainfall make it difficult to establish adequate stands of grass. In parks where large amounts of fertilizer and water are used, fair stands of bermudagrass can be maintained. The potential is low for wildlife habitat.

The potential is medium for urban use. Low strength and seepage are the main limitations. The potential is medium for recreational use. Slope and a dusty surface layer are the main restrictive features.

Capability subclass VIIe nonirrigated; Arents in Loamy range site.

10—Berda loam, 1 to 3 percent slopes. This deep, gently sloping soil is on foot slopes along draws. It occurs as long areas that range from 20 to 200 acres.

The surface layer is friable, moderately alkaline, brown loam about 8 inches thick. From 8 to 24 inches is friable, moderately alkaline, brown loam that has a few concretions, films, and threads of calcium carbonate. From 24 to 41 inches is friable, moderately alkaline, light brown loam that is about 5 percent visible calcium carbonate in soft powdery forms. From 41 to 72 inches is friable, moderately alkaline, reddish brown loam that has a few concretions of calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included in some areas of this soil are small areas of Bippus, Mansker, and Posey soils. Inclusions make up less than 15 percent of any one mapped area.

This soil is used as cropland and range. Cotton and grain sorghum are the main crops, but other crops can be grown.

The potential is medium for irrigated and nonirrigated grain sorghum and wheat. It is medium for irrigated cotton and low for nonirrigated cotton. Keeping crop residue on or near the surface conserves moisture and helps to control soil blowing and water erosion. In dry years, emergency tillage is needed to control soil blowing if residue does not furnish adequate protection. Fertilizer is needed if the soil is irrigated. A designed irrigation system and proper application of irrigation water are essential. Either surface irrigation or sprinkler irrigation can be used.

This soil has high potential for native range plants. Native range plants are mainly mid and short grasses that produce a high amount of forage. The potential is medium for wildlife habitat.

This soil has high potential for most urban and recreational use. It is corrosive to uncoated steel and has low strength, but these limitations can be easily overcome by good design and careful installation.

Capability subclass IIIe nonirrigated and irrigated; Hardland Slopes range site.

11—Berda loam, 3 to 5 percent slopes. This deep, gently sloping soil is on the sides of draws. It occurs as long narrow areas that range from 20 to 200 acres.

The surface layer is friable, moderately alkaline, grayish brown loam about 8 inches thick (fig. 5). From about 8 to 20 inches is friable, moderately alkaline, grayish brown loam that has a few fine concretions, films, and threads of calcium carbonate. From 20 to 28 inches is friable, moderately alkaline, light reddish brown loam that also has a few fine concretions, films, and threads of calcium carbonate. From 28 to 40 inches is friable, moderately alkaline, light brown loam that has a few visible calcium carbonate threads in soft powdery forms and concretions. From 40 to 60 inches is friable, moderately alkaline, brown loam that has a few visible calcium carbonate threads in concretions and soft masses.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium. The root zone is deep. The hazard of water erosion is severe, and the hazard of soil blowing is moderate.

Included in mapping are spots of Bippus, Mansker, and Posey soils and a few areas of a soil that is similar to the Berda soil but has a darker colored surface layer. These included soils make up less than 20 percent of any one mapped area.

This soil is used as cropland and range. Cotton and wheat are the main crops, but other crops can be grown.

The potential is medium for irrigated cotton and low for nonirrigated cotton. It is medium for irrigated wheat and low for nonirrigated wheat. It is low for irrigated and nonirrigated grain sorghum. The low rainfall, slope, and susceptibility to water erosion are the most limiting factors. Crop residue should be kept on the surface in order to conserve moisture and control water erosion and soil blowing in cultivated areas. Contour farming and terraces are essential in controlling excess runoff. Emergency tillage is needed during dry years when crop residue provides inadequate protection. Fertilizer is needed if the soil is irrigated. A designed sprinkler irrigation system and proper application of irrigation water are essential.

This soil has high potential for native range plants. Native range plants are mainly mid and short grasses, which produce a large amount of forage. The potential is medium for wildlife habitat.

This soil has high potential for most urban and recreational use. It is corrosive to uncoated steel and has low strength, but these limitations can be easily overcome by good design and installation. Keeping an adequate vegetative cover is essential because of the slope and the high susceptibility to water erosion.

Capability subclass IVe nonirrigated and irrigated; Hardland Slopes range site.

12—Berda-Potter association, hilly. The deep and very shallow, hilly soils of this association are on foot slopes below steep escarpments. Slopes range from 10 to 30 percent. Mapped areas are irregularly shaped and range from 25 to several hundred acres.

Berda soils make up about 60 percent of this association, Potter soils about 30 percent, and other soils about 10 percent. The delineations of this association are much larger and the composition more variable than those of other map units in the county. Mapping was controlled well enough, however, for the anticipated use of the areas.

Berda soils have a concave surface. They occupy the less sloping areas. The surface layer is friable, moderately alkaline, reddish brown loam about 10 inches thick that has a few concretions of calcium carbonate. From 10 to 24 inches is very friable, moderately alkaline, reddish brown loam that has common films, threads, and concretions of calcium carbonate. From 24 to 34 inches is very friable, moderately alkaline, reddish brown light sandy clay loam that is about 3 percent visible soft powdery masses of calcium carbonate. From 34 to 60 inches is friable, moderately alkaline, yellowish red loam that has a few films, threads, and concretions of calcium carbonate.

Berda soils are well drained. Surface runoff is medium. Permeability is moderate. Available water capacity is medium. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is severe. The hazard of soil blowing is moderate.

Potter soils have a convex surface. They occupy the steeper parts of this association. The 4-inch surface layer is friable, moderately alkaline, brown gravelly loam that is about 20 percent by volume hard caliche fragments. From 4 to 12 inches is friable, moderately alkaline, light brown gravelly loam that is about 35 percent by volume hard caliche fragments up to 2 inches in diameter. From 12 to 20 inches is moderately alkaline, pinkish white, weakly cemented caliche that can be cut with a spade. From 20 inches to more than 30 inches is moderately alkaline silty shale that has seams of calcium carbonate.

Potter soils are well drained. Surface runoff is rapid. Permeability is moderate. Available water capacity is very low. Fertility is low, and the hazard of water erosion is severe.

Included in mapping are spots of Mobeetie soils and exposed geologic material. These included spots make up about 10 percent of any one mapped area.

This association is used for range and recreation. It is not suitable as cropland. The potential is low for range, low to medium for wildlife habitat, and low for most urban and recreational use. The potential for all uses is limited by steep slopes and the severe hazard of water erosion (fig. 6).

Berda soil in capability subclass VIe, Hardland Slopes range site; Potter soil in capability subclass VIIs, Very Shallow range site.

13—Bippus fine sandy loam, frequently flooded. This deep, nearly level soil is in drainageways and on bottom lands of draws that are frequently flooded. It occurs as long areas that range from 10 to 150 acres. Slopes are 0 to 1 percent.

The surface layer is very friable, moderately alkaline, dark brown fine sandy loam 6 inches thick. From 6 to 24

inches is very friable, moderately alkaline, brown fine sandy loam. From 24 to 34 inches is friable, moderately alkaline, brown clay loam. From 34 to 52 inches is friable, moderately alkaline, reddish brown sandy clay loam that has a few films and threads of calcium carbonate. From 52 to 60 inches is friable, moderately alkaline, brown sandy clay loam that has films and threads of calcium carbonate. From 60 to 64 inches is friable, moderately alkaline, reddish brown sandy clay loam that has a few films and threads of calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is high. The root zone is deep and is easily penetrated. The hazards of water erosion and soil blowing are slight.

Included in some areas of this soil are areas of Mobeetie fine sandy loam and spots of a similar soil that has a fine sandy loam surface layer less than 20 inches thick. These included soils make up less than 10 percent of any one mapped area.

This soil is used entirely as range. It is not suitable as cropland because it is flooded frequently.

The potential is high for native range plants. Runoff from adjacent slopes helps to produce good yields of forage during favorable years. This soil has medium potential for wildlife habitat.

The potential is low for urban and recreational use. Possibility of flooding and corrosivity to uncoated steel are the most restrictive features.

Capability subclass Vw nonirrigated; Draw range site.

14—Bippus clay loam, occasionally flooded. This deep, nearly level soil is in drainageways and on adjacent outwash fans. It occasionally receives runoff from adjacent slopes of upland soils. It occurs as long narrow areas that extend for several miles. Slopes are 0 to 1 percent.

The surface layer is very friable, mildly alkaline, dark brown clay loam about 30 inches thick. Buried soil layers occur below 30 inches in some areas (fig. 7). From 30 to 55 inches is very friable, moderately alkaline, brown clay loam. In the upper part are a few films and threads of calcium carbonate. From 55 to 72 inches is very friable, moderately alkaline, brown clay loam.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is high. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

Included in some areas are a few areas of a soil that is similar to the Bippus soil but has a sandier surface layer. Also included are a few areas of soils that have a lighter colored surface layer. Included soils make up less than 10 percent of any one mapped area.

This soil is used as cropland. Cotton, grain sorghum, wheat, and soybeans are the main crops.

The potential is high for nonirrigated and irrigated cotton, grain sorghum, soybeans, and wheat. Keeping crop residue on or near the surface conserves moisture and helps to prevent water erosion and soil blowing. Diversion terraces and grassed waterways help to control excess runoff from adjacent slopes. Irrigated crops need to be fertilized. A designed irrigation system and proper application of irrigation water are essential. Either surface or sprinkler irrigation can be used.

The potential is high for native range plants. Runoff from adjacent slopes helps to produce good yields of forage during favorable years. This soil has high potential for wildlife habitat.

The potential is low for urban use. Possibility of flooding, shrinking and swelling with changes in moisture, and corrosivity to uncoated steel are the most restrictive features. The potential is also low for recreational use. Flooding and the clay loam surface layer are the most restrictive features.

Capability subclass IIw nonirrigated and irrigated; Draw range site.

15—Bippus clay loam, frequently flooded. This deep, nearly level soil is in drainageways and on adjacent outwash fans and is frequently flooded. It receives runoff from adjacent slopes of upland soils. It occurs as one long area of about 1,290 acres. Slopes are 0 to 1 percent.

The surface layer is friable, moderately alkaline clay loam, about 24 inches thick, that is brown in the upper 4 inches and dark grayish brown in the lower 20 inches. From 24 to 62 inches is very friable, moderately alkaline, brown sandy clay loam.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is high. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

On about 35 percent of the acreage, this soil is covered with 3 to 18 inches of fine sandy loam of recent origin.

This soil is used entirely as range. It is not suitable as cropland because it is flooded frequently. The potential is high for native range plants. Runoff from adjacent slopes helps to produce good yields of forage during favorable years. This soil has medium potential for wildlife habitat.

The potential is low for urban and recreational use. The hazard of flooding and corrosivity to uncoated steel are the most restrictive features.

Capability subclass Vw nonirrigated; Draw range site.

16—Drake clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on convex sides of low duned areas on the eastern side of playas or in large enclosed depressions. It occurs as elliptical to long areas that range from 5 to 90 acres. Local shifting of soil by wind is evident in places.

The surface layer is friable, moderately alkaline, grayish brown clay loam about 10 inches thick. From 10 to 60 inches is friable, moderately alkaline clay loam that has a few soft masses of calcium carbonate in the lower part (fig. 8). It is light brownish gray in the upper 18 inches and light gray below.

This soil is well drained. Surface runoff is rapid. Permeability is moderate, and available water capacity is medium. The root zone is deep and is easily penetrated by

plant roots. The hazards of water erosion and soil blowing are moderate.

Included in some areas of this soil are small areas of Estacado, Midessa, and Posey soils. Included soils make up less than 10 percent of any one mapped area.

This soil is used as cropland and range. Grain sorghum and wheat are the main crops, but other crops can be grown. This soil has low potential for nonirrigated and irrigated grain sorghum, wheat, and cotton. Good management includes growing crops that produce large amounts of residue and leaving residue on the surface when crops are not growing. These practices conserve moisture and control soil blowing and water erosion. Occasionally, emergency tillage is needed to roughen the surface and thus reduce the damage caused by soil blowing when crops and residue provide inadequate protection. A well designed sprinkler irrigation system and proper application of irrigation water are essential. If irrigated, this soil needs to be fertilized.

This soil has medium potential for native range plants. Its potential is limited by medium available moisture and excess amounts of calcium carbonate in the root zone. Native plants are generally short grasses that produce a medium amount of forage. The potential is medium for wildlife habitat.

This soil has medium potential for most urban and recreational use. It is corrosive to uncoated steel, has low strength, and is dusty. Careful installation and good design are essential.

Capability subclass IVe nonirrigated and IIIe irrigated; High Lime range site.

17—Drake clay loam, 3 to 5 percent slopes. This deep, gently sloping soil is on convex low duned uplands on the eastern sides of playas or in large enclosed depressions. It occurs as long to elliptical areas. Local shifting of soil by wind is evident in some places.

The surface layer is friable, moderately alkaline, grayish brown clay loam about 10 inches thick. From 10 to 60 inches is friable, moderately alkaline clay loam that has visible soft masses of calcium carbonate throughout. This layer is light gray in the upper 12 inches and very pale brown below.

This soil is well drained. Surface runoff is rapid. Permeability is moderate, and available water capacity is medium. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included in some areas of this soil are small areas of Arch, Mansker, Midessa, and Posey soils. Included soils make up less than 10 percent of any one mapped area.

This soil is used as range and cropland. The main crops are grain sorghum and wheat. Some areas are in native grass and are not fenced or grazed.

This soil is not suitable as cropland unless it is irrigated. It has low potential for irrigated grain sorghum and wheat. A well designed sprinkler irrigation system and proper application of irrigation water are needed because of rapid runoff. Good management includes growing crops that produce large amounts of residue and leaving residue on the surface when crops are not growing. These practices conserve moisture and help to control soil blowing and water erosion. Residue also helps to maintain soil productivity. Occasionally, emergency tillage is needed to roughen the surface and thus reduce the damage caused by soil blowing when crops and residue give inadequate protection. This soil responds well to fertilizer.

This soil has medium potential for native range plants. Its potential is limited because of medium available moisture during the growing season and excess lime in the root zone. Native plants are mainly short grasses, which produce a medium amount of forage. The potential is medium for wildlife habitat.

The potential is medium for most urban and recreational development. This soil is corrosive to uncoated steel, has low strength, and is dusty when dry. Good design and careful installation are needed.

Capability subclass VIe nonirrigated, IVe irrigated; High Lime range site.

18—Estacado clay loam, 0 to 1 percent slopes. This deep, nearly level soil is on upland plains. It occurs as irregularly shaped areas that range from 10 to several hundred acres.

The surface layer is friable, moderately alkaline, brown clay loam about 16 inches thick. From 16 to 26 inches is friable, moderately alkaline, brown clay loam that has a few concretions of calcium carbonate. From 26 to 40 inches is friable, moderately alkaline, light brown clay loam that has many soft masses and concretions of calcium carbonate. From 40 to 66 inches is friable, moderately alkaline, reddish yellow clay loam that also has many soft masses and concretions of calcium carbonate (fig. 9).

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is high. Tilth is good. The root zone is easily penetrated by roots. The hazard of water erosion is slight. The hazard of soil blowing is moderate.

Included in some areas of this soil are small areas of Acuff, Amarillo, and Portales soils. These included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as cropland. A few small areas are range. Cotton is the main crop, but other crops can be grown.

This soil has high potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. Careful managment is needed to keep crop residue on the surface during critical periods of erosion. Residue management helps to control soil blowing and water erosion and conserve moisture. It also helps to maintain soil productivity. Occasionally, emergency tillage is needed to roughen the surface and thus reduce the damage caused by soil blowing when crops and residue do not provide adequate protection. This soil needs to be fertilized if it is irrigated. Either surface or sprinkler irrigation can be used. A well designed irrigation system and and proper application of irrigation water are essential.

This soil has medium potential for native range plants. Low rainfall limits production. Native range plants are mainly short grasses, which produce a medium amount of forage. The potential is medium for wildlife habitat.

This soil has medium potential for most urban use. Corrosivity to uncoated steel, low strength, and the clayey surface layer are the most limiting features, but they are easily overcome by good design and careful installation. The potential is medium for recreational use. The clay loam surface layer is the most limiting feature.

Capability subclass IIIe nonirrigated, IIe irrigated; Loamy range site.

19—Estacado clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands adjacent to playas. It occurs as narrow, long, elliptical areas that range from 10 to 100 acres.

The surface layer is friable, moderately alkaline, dark brown clay loam about 14 inches thick. From 14 to 20 inches is friable, moderately alkaline, brown clay loam. From 20 to 34 inches is friable, moderately alkaline, yellowish red clay loam that is about 10 percent by volume soft masses of calcium carbonate. From 34 to 80 inches is friable, moderately alkaline, reddish yellow clay loam that is about 35 percent by volume calcium carbonate in the upper 26 inches and 10 percent below.

This soil is well drained. Surface runoff is medium, and permeability is moderate. Available water capacity is high. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included in some areas of this soil are spots of Acuff, Amarillo, Mansker, and Posey soils. These inclusions make up less than 10 percent of any one mapped area.

This soil is used mainly as cropland. Some areas are used as range. Cotton, grain sorghum, and wheat are the main crops, but other crops can be grown.

The potential is high for nonirrigated and irrigated cotton, grain sorghum, and wheat. Keeping crop residue on or near the surface conserves moisture and helps to control water erosion and soil blowing. Emergency tillage is sometimes needed to control soil blowing if crop residue does not provide adequate protection. A designed surface or sprinkler irrigation system and proper application of irrigation water are needed. Fertilizer is needed if this soil is irrigated.

The potential is medium for native range plants. Short and mid grasses produce moderate yields during favorable years. The potential is medium for wildlife habitat.

This soil has medium potential for most urban use. It is corrosive to uncoated steel, has low strength, and has a surface layer that is too clayey. The potential is medium for recreational use because the surface is too clayey.

Capability subclass IIIe nonirrigated, IIIe irrigated; Loamy range site.

20—Estacado-Urban land complex, 0 to 2 percent slopes. This nearly level to gently sloping map unit is on uplands. It occurs as irregularly shaped areas that range from 15 to several hundred acres. It is about 60 percent Estacado soils, 30 percent Urban land, and 10 percent other soils.

The deep Estacado soil has a surface layer of friable, moderately alkaline, brown clay loam about 16 inches thick. From 16 to 28 inches is friable, moderately alkaline, brown clay loam that has a few concretions of calcium carbonate. From 28 to 40 inches is friable, moderately alkaline, pink clay loam that has many soft masses and concretions of calcium carbonate. From 40 to 80 inches is friable, moderately alkaline, reddish yellow clay loam that also has many soft masses and concretions of calcium carbonate.

Urban land consists of residential and commercial buildings, driveways, streets, sidewalks, and parking lots.

Surface runoff is high because a large acreage is covered by works and structures, which shed most of the precipitation. The Estacado soil has good tilth, is high in natural fertility, and is well drained. The root zone is easily penetrated by roots.

Included in mapping are areas of Mansker, Posey, Portales, and Zita soils. Included soils make up less than 15 percent of any one mapped area.

This unit is entirely in urban use. Estacado soils are used for lawn grasses, ornamental trees and shrubs, and flower and vegetable gardens.

The potential is high for most urban use. Corrosivity to uncoated steel and low strength are the most limiting factors but are easily overcome by good design and careful installation. The potential is medium for recreation use. The main limitation is the clay loam surface layer.

The potential is low for cropland and range.

21—Friona loam, 0 to 1 percent slopes. This moderately deep, nearly level soil is on uplands. It occurs as irregularly shaped areas that range from 25 to more than 200 acres.

The surface layer is very friable, mildly alkaline, reddish brown sandy clay loam about 8 inches thick. From 8 to 26 inches is friable, moderately alkaline, reddish brown clay loam that has a few films and threads of calcium carbonate in the lower part. From 26 to 32 inches is pinkish white caliche that is indurated in the upper part and strongly cemented in the lower part. From 32 to 60 inches is friable, moderately alkaline, pink sandy clay loam that is about 50 percent by volume soft powdery calcium carbonate.

This soil is well drained. Surface runoff is slow, permeability is moderate, and available water capacity is high. Tilth is good, but the root depth is restricted by the cemented layer at a depth of about 26 inches. The hazards of water erosion and soil blowing are slight.

Included in some areas of this soil are spots of Acuff and Kimbrough soils and a soil that is similar to the Friona soil but is calcareous to the surface. Included soils make up less than 15 percent of any one mapped area.

This soil is used entirely as cropland. Cotton, grain sorghum, and wheat are the main crops, but other crops can be grown.

This soil has medium potential for nonirrigated and irrigated cotton, grain sorghum, wheat, and soybeans. Good management includes leaving residue on the surface when crops are not growing, using timely and limited tillage, and rotating crops. These practices conserve moisture and help to control soil blowing. Residue also helps to maintain soil productivity. Occasionally, emergency tillage is needed to roughen the surface and thus reduce the damage caused by soil blowing when crops and residue provide inadequate protection. A well designed irrigation system and proper application of irrigation water are essential. Surface or sprinkler irrigation can be used. If irrigated, this soil needs to be fertilized.

This soil has medium potential for native range plants. Its potential is limited because of low available moisture during the growing season. Native plants are mainly short grasses, which produce a medium amount of forage. The potential is medium for wildlife habitat.

This soil has medium potential for urban use. It is corrosive to uncoated steel, has low strength, and has a cemented pan. The potential is high for recreational use.

Capability subclass IIIe nonirrigated, IIe irrigated; Clay Loam range site.

22—Kimbrough loam, 0 to 3 percent slopes. This shallow, nearly level to gently sloping soil is on uplands. It occurs as round or long narrow areas on slightly convex ridges and slightly elevated knolls. These areas range from 5 to more than 100 acres.

The surface layer is friable, mildly alkaline, brown loam about 11 inches thick. About 20 percent of the surface is covered with hard caliche fragments. At a depth of 11 to 14 inches is pinkish white indurated platy caliche. The few fractures in the caliche are filled with soil material and plant roots (fig. 10). The upper part of the surface is laminar and smooth and becomes softer below the laminar cap. From 14 to 34 inches is pinkish white sandy clay loam that is about 70 percent by volume weakly cemented caliche fragments that range from 1 to 3 inches in diameter.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is very low. The root depth is shallow. The hazards of water erosion and soil blowing are slight.

Included in some areas of this soil are spots of Friona soil and a soil that is similar to the Kimbrough soil but has a lighter colored surface layer. Included soils make up less than 35 percent of any one mapped area.

This soil is used as range and cropland. Wheat is the main crop, but other crops are grown. Many areas are idle and are used for equipment storage.

This soil has low potential as cropland. Most areas in cropland are small and are cultivated with the surrounding deep soils.

The potential is low for native range plants because of the shallow root zone and low available moisture during the growing season. Native range plants are mainly short grasses, which produce low yields of forage. The potential is low for wildlife habitat.

This soil has low potential for most urban use. It is corrosive to uncoated steel and very shallow over the cemented pan. These limitations are difficult to overcome. This soil has high potential for most recreational use, except playgrounds, which are severely limited by stones on the surface and by the shallow depth over the cemented pan.

Capability subclass VIIs; Very Shallow range site.

23—Lofton clay loam, 0 to 1 percent slopes. This deep, nearly level soil is on benches above playas or in slight depressions on uplands. It occurs as generally elliptical areas that range from 10 to 60 acres.

The surface layer is friable, mildly alkaline, dark gray clay loam about 10 inches thick. From 10 to 26 inches is firm, mildly alkaline, dark gray clay. From 26 to 40 inches is firm, moderately alkaline, dark grayish brown clay that has a few films and threads of calcium carbonate. From 40 to 50 inches is friable, moderately alkaline, grayish brown clay that has common visible films, threads, and soft masses of calcium carbonate. From 50 to 64 inches is friable, moderately alkaline, light brownish gray clay loam that is about 35 percent by volume visible soft calcium carbonate. From 64 to 72 inches is friable, moderately alkaline, light brownish gray clay loam that is about 15 percent visible calcium carbonate.

This soil is moderately well drained. Surface runoff is very slow. Permeability is very slow, and available water capacity is high. This soil is difficult to work because it is hard when dry and sticky when wet. The root zone is deep, but roots have difficulty in penetrating the soil. The hazards of water erosion and soil blowing are slight.

Included in some areas of this soil are small areas of Pullman and Zita soils and a soil that is similar to the Lofton soil but is calcareous to the surface. These inclusions make up less than 10 percent of any one mapped area.

This soil is used as cropland and range. Cotton is the main crop, but other crops can be grown.

This soil has medium potential for nonirrigated cotton, grain sorghum, and wheat and high potential for irrigated cotton, grain sorghum, wheat, and soybeans. Good management includes leaving crop residue on the surface, using timely and limited tillage, and rotating crops. These practices conserve moisture and help to control soil blowing. Emergency tillage is sometimes needed to roughen the surface and thus reduce the damage caused by soil blowing when plant growth and residue provide inadequate cover. A well designed surface irrigation system is needed. If irrigated, this soil needs to be fertilized.

This soil has medium potential for native range because of low available moisture during the growing season. Native range plants are mainly short grasses, which produce a medium amount of forage. The potential is medium for wildlife habitat.

This soil has low potential for most urban and recreational use. It is corrosive to uncoated steel, shrinks and swells with moisture changes, and has a surface layer that is too clayey.

Capability subclass IIIe nonirrigated, IIs irrigated; Clay Loam range site.

24—Mansker clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands along draws and around playas. It occurs as long areas that range from 5 to 150 acres.

The surface layer is friable, moderately alkaline, brown clay loam, about 8 inches thick, that has a few small concretions of calcium carbonate. From 8 to 15 inches is friable, moderately alkaline, light brown clay loam that is about 35 percent by volume concretions of calcium carbonate. From 15 to 32 inches is friable, moderately alkaline, pink clay loam that is about 60 percent by volume soft masses and small cemented concretions of calcium carbonate. From 32 to 60 inches is friable, moderately alkaline, reddish yellow clay loam that is about 10 percent by volume concretions of calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included in many areas of this soil is a soil that is similar to the Mansker soil but has a lighter colored surface layer. This soil makes up as much as 30 percent of some mapped areas. A few small areas of Estacado and Posey soils are also included in some areas.

This soil is used as cropland and range. Cotton is the main crop, but other crops can be grown.

This soil has low potential for nonirrigated cotton, grain sorghum, and wheat. If irrigated, it has medium potential for these crops. Good management includes leaving residue on the surface when crops are not growing, using timely and limited tillage, and rotating crops. These practices conserve moisture and help to control soil blowing and water erosion. Residue also helps to maintain soil productivity. Occasionally emergency tillage is needed to roughen the surface and thus reduce the damage caused by soil blowing when crops and residue provide inadequate protection. A well designed surface or sprinkler irrigation system and proper application of irrigation water are essential. If irrigated, the soil needs to be fertilized.

This soil has medium potential for native range plants. Native plants are mainly short grasses, which produce a medium amount of forage. The potential is medium for wildlife habitat.

This soil has medium potential for most urban and recreation use. It is corrosive to uncoated steel, has low strength, and is too clayey. Good design and careful installation are needed if urban works and structures are to function satisfactorily.

Capability subclass IVe nonirrigated, IIIe irrigated; Loamy range site.

25—Mansker clay loam, 3 to 5 percent slopes. This deep, gently sloping soil is on uplands, around playas, and at the upper edges of draws. It occurs as long areas that range from 5 to 15 acres.

The surface layer is friable, moderately alkaline, brown clay loam about 7 inches thick that has a few small concretions of calcium carbonate. From 7 to 14 inches is friable, moderately alkaline, pale brown clay loam that has many small concretions of calcium carbonate. From 14 to 28 inches is friable, moderately alkaline, pinkish gray clay loam that is about 60 percent by volume weakly cemented concretions of calcium carbonate. From 28 to 62 inches is friable, moderately alkaline, yellowish red clay loam that is about 60 percent by volume calcium carbonate.

This soil is well drained. Surface runoff is rapid. Permeability is moderate, and available water capacity is medium. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is severe. The hazard of soil blowing is moderate.

About 35 percent of most areas mapped is a soil that is similar to Mansker clay loam but has a lighter colored surface layer. Also included are small areas of Posey soils that make up about 5 percent of some mapped areas.

This soil is used as cropland and range. Wheat is the main crop, but other crops are grown.

This soil has low potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. Good management includes leaving residue on the surface when crops are not growing, using timely and limited tillage, and rotating crops. These practices conserve moisture and help to control soil blowing and water erosion. Residue also helps in maintaining productivity. Terraces are needed. Occasionally, emergency tillage is needed to roughen the surface and thus reduce the damage from soil blowing when crops and residue provide inadequate protection. A well designed sprinkler irrigation system and the use of fertilizer are needed if this soil is irrigated.

This soil has medium potential for native range plants. Native plants are mainly short grasses, which produce a medium amount of forage. The potential is medium for wildlife habitat.

This soil has medium potential for most urban and recreational use. It is corrosive to uncoated steel, has low strength, and has a surface layer that is too clayey. Good design and careful installation are needed for most urban works and structures to function satisfactorily.

Capability subclass IVe nonirrigated, IVe irrigated; Loamy range site.

26—Midessa fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on convex uplands. It occurs as areas that range from 10 to 150 acres. Local shifting of soils by wind is evident in some places.

The surface layer, about 7 inches thick, is friable, moderately alkaline, brown fine sandy loam that has a few fine concretions of calcium carbonate. From 7 to 23 inches is friable, moderately alkaline, brown sandy clay loam that has a few films, threads, and fine concretions of calcium carbonate. From 23 to 44 inches is friable, moderately alkaline, light gray sandy clay loam that is about 30 percent by volume soft masses and concretions of calcium carbonate. From 44 to 66 inches is friable,

moderately alkaline, pinkish white sandy clay loam that is about 5 percent by volume visible calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included in some areas of this soil are spots of Acuff, Amarillo, Arch, Drake, and Estacado soils. Included soils make up less than 15 percent of any one mapped area.

This soil is used as cropland. Cotton and grain sorghum are the main crops.

The potential is medium for nonirrigated and irrigated cotton and grain sorghum. Crop residue must be kept on or near the surface. Residue helps to control water erosion and soil blowing and conserves moisture. In dry years, emergency tillage is needed to help control soil blowing when crop residue does not furnish adequate protection. Contour farming, terraces, and grassed waterways are needed to help control water erosion. A designed irrigation system and proper application of irrigation water are essential. Fertilizer is needed if this soil is irrigated. Sprinkler irrigation is best adapted. If surface irrigation is used, bench leveling is needed.

The potential is high for native range plants. Low rainfall is the most limiting factor, but yields of short and mid grasses are good during favorable years. The potential is medium for wildlife habitat.

The potential is high for most urban use. Slope, seepage, low strength, and corrosivity to uncoated steel are the most restrictive features but can be easily overcome by good design and careful installation. The potential is high for recreational use. Slope restricts the use of some areas as playgrounds.

Capability subclass IIIe nonirrigated, IIIe irrigated; Sandy Loam range site.

27—Mobeetie fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands. It occupies narrow foot slopes and alluvial fans. It occurs as generally oblong areas that range from 12 to 150 acres. Local shifting of soils by wind is evident in some places.

The top 8 inches is very friable, moderately alkaline, brown fine sandy loam that has a few fine concretions of calcium carbonate. From 8 to 18 inches is very friable, moderately alkaline, brown fine sandy loam that has films and threads of calcium carbonate. From 18 to 34 inches is friable, moderately alkaline, brown fine sandy loam that has many films and threads of calcium carbonate. It is about 1 percent by volume concretions of calcium carbonate. From 34 to 60 inches is friable, moderately alkaline, pink fine sandy loam that has a few films and threads of calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

Included in some areas of this soil are small areas of Berda and Potter soils. These included soils make up less than 10 percent of any one mapped area.

This soil is used mainly as range, but it can be cultivated to nonirrigated and irrigated cotton, grain sorghum, and wheat.

The potential is medium for nonirrigated and irrigated cotton, grain sorghum, and wheat. Crop residue must be kept on or near the surface to help control water erosion and soil blowing and conserve moisture. Emergency tillage is sometimes needed to help control soil blowing when crop residue does not furnish adequate protection. Contour farming, terraces, and grassed waterways are needed to help control water erosion. A designed irrigation system and proper application of irrigation water are essential. Fertilizer is needed if this soil is irrigated. Sprinkler irrigation is best adapted. If surface irrigation is used, bench leveling is needed.

The potential is high for native range plants. Low rainfall is the most limiting factor, but yields of short and mid grasses are good during favorable years. The potential is medium for wildlife habitat.

The potential is high for most urban use. Seepage is the most restrictive feature. Water-retaining earthen structures should be avoided. The potential is high for recreational use. Slope restricts the use of some areas as playgrounds.

Capability subclass IIIe nonirrigated, IIIe irrigated; Mixedland Slopes range site.

28—Mobeetie fine sandy loam, 3 to 5 percent slopes. This deep, gently sloping soil is on uplands. It occupies narrow foot slopes and alluvial fans. Mapped areas are generally oblong and range from 20 to 200 acres. Local shifting of soil by wind is evident in some places.

The surface layer is very friable, moderately alkaline, grayish brown fine sandy loam, about 10 inches thick, that has a few caliche fragments and fine concretions of calcium carbonate. From 10 to 26 inches is very friable, moderately alkaline, pale brown fine sandy loam that has a few films, threads, and concretions of calcium carbonate and small caliche fragments. From 26 to 72 inches is friable, moderately alkaline, pink fine sandy loam that has many films and threads of calcium carbonate in the upper 16 inches. The calcium carbonate content decreases with increasing depth.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium. The root zone is deep. The hazard of water erosion is severe. The hazard of soil blowing is moderate.

Included in mapping are small areas of Berda and Potter soils. These inclusions make up less than 15 percent of any one mapped area.

Most areas of this soil are used as range. Only a few areas are cultivated. Small grain is the major crop.

The potential is low for nonirrigated and irrigated grain sorghum and wheat. If the soil is cultivated, keeping crop residue on or near the surface is necessary to conserve moisture and help to control water erosion and soil blow-

ing. Contour farming, terraces, and grassed waterways are necessary to help control excess runoff. Emergency tillage is sometimes needed to help control soil blowing. A designed irrigation system and proper application of irrigation water are essential. Fertilizer is needed if this soil is irrigated. Sprinkler irrigation is best adapted. If surface irrigation is used, bench leveling is needed.

The potential is high for native range plants. Low rainfall is the most limiting factor, but yields of short and mid grasses are good during favorable years. The potential is medium for wildlife habitat.

The potential is high for urban use. Seepage is the most restrictive factor. No water-retaining structures should be built in the soil. Slope can also be a problem to small commercial buildings. The potential is high for recreational use. Slope restricts the use of some areas as playgrounds.

Capability subclass IVe nonirrigated, IVe irrigated; Mixedland Slopes range site.

29—Mobeetie fine sandy loam, 5 to 8 percent slopes. This deep, sloping soil is on uplands along foot slopes and on alluvial fans. It occurs as long areas that range from 10 to 200 acres. Local shifting of soil by wind is evident in some places.

The 9-inch surface layer is very friable, moderately alkaline, brown fine sandy loam that has a few fine caliche fragments and fine concretions of calcium carbonate. From 9 to 25 inches is very friable, moderately alkaline, light brown fine sandy loam that has a few films, threads, and concretions of calcium carbonate and caliche fragments up to 1 centimeter in diameter. From 25 to 60 inches is friable, moderately alkaline, pink fine sandy loam that has many films and threads of calcium carbonate in the top 21 inches and common films and threads in the lower part.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium. The root zone is deep. The hazard of water erosion is severe. The hazard of soil blowing is moderate.

Included in some areas of this soil are spots of Berda and Potter soils. These included soils make up less than 10 percent of any one mapped area.

This soil is used entirely as range. It is not suitable as cropland because of slope.

The potential is high for native range plants. Good management is needed to keep this soil from eroding. The potential is medium for wildlife habitat.

This soil has high potential for most urban use. Slope and seepage are the most restricting features for sewage lagoons. Slope restricts use of the soil as a site for small commercial buildings. The potential is high for most recreational use. Playgrounds are severely limited by slope.

Capability subclass VIe nonirrigated; Mixedland Slopes range site.

30—Olton clay loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands. It occurs as irregularly shaped areas that range from 10 to several hundred acres.

The 10-inch surface layer is friable, mildly alkaline, brown clay loam. From 10 to 18 inches is firm, mildly alkaline, brown clay loam. From 18 to 30 inches is firm, moderately alkaline, reddish brown clay loam. From 30 to 42 inches is firm, moderately alkaline, reddish brown clay loam that has a few visible films and threads of calcium carbonate. From 42 to 80 inches is friable, moderately alkaline clay loam that is pink in the upper 18 inches and yellowish red in the lower 20 inches (fig. 11).

This soil is well drained. Surface runoff is very slow. Permeability is moderately slow, and available water capacity is high. The root zone is deep, but the dense nature of the lower layers tends to impede the movement of air, water, and roots through the soil. The hazards of water erosion and soil blowing are slight.

Included in some areas are small areas of Acuff, Estacado, Lofton, and Pullman soils. Also included are areas of a soil that is similar to the Olton soil but has a dark colored layer at a depth of 36 to 60 inches. In some areas the layer that has a large amount of calcium carbonate is more than 60 inches deep. In a few areas the dark colored surface layer is more than 20 inches thick. These included soils make up less than 10 percent of any one mapped area.

Most areas are used as cropland. A few are in native range plants. Cotton and grain sorghum are the main crops, but other crops can be grown.

The potential is medium for nonirrigated cotton, grain sorghum, and wheat and high for irrigated cotton, grain sorghum, soybeans, and wheat. Keeping crop residue on or near the surface conserves moisture and protects the soil against water erosion and soil blowing. Emergency tillage is sometimes needed to help control soil blowing. Fertilizer is needed if this soil is irrigated. A designed irrigation system and proper application of irrigation water are essential. Either surface or sprinkler irrigation can be used.

The potential is medium for native range plants. Low rainfall produces moderate yields of short and mid grasses during favorable years. The potential is medium for wildlife habitat.

The potential is medium for most urban and recreational use. This soil is corrosive to uncoated steel. It shrinks and swells as the moisture content changes, and it is too clayey, has low strength, and has slow water percolation. Structures should be designed well enough to withstand the adverse effects of these problems.

Capability subclass IIIe nonirrigated, IIe irrigated; Clay Loam range site.

31—Olton clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands, mainly around playas and along drainageways. Mapped areas are irregularly shaped and range from 10 to more than 100 acres.

The surface layer is friable, mildly alkaline, brown clay loam about 8 inches thick. From 8 to 24 inches is firm, mildly alkaline clay loam that is dark reddish brown in the upper 8 inches and reddish brown in the lower 8 inches. From 24 to 38 inches is firm, moderately alkaline,

reddish brown clay loam that has a few films, threads, and soft masses of calcium carbonate. From 38 to 72 inches is friable, moderately alkaline, yellowish red clay loam that is about 40 percent by volume soft masses of calcium carbonate in the upper 20 inches and about 10 percent below.

This soil is well drained. Surface runoff is slow. Permeability is moderately slow, and available water capacity is high. The root zone is deep, but the dense nature of the lower layers tends to impede the movement of air, water, and plant roots through the soil. The hazard of water erosion is moderate. The hazard of soil blowing is slight.

Included in some areas are small areas of Acuff and Estacado soils. In some areas the layer of calcium carbonate is deeper than 60 inches, and in some a dark colored clayey layer is at a depth of 36 to 60 inches. These included soils make up less than 5 percent of any one mapped area.

Most areas are used as cropland. A few areas are in native range grasses. Cotton and grain sorghum are the main crops, but other crops can be grown.

This soil has medium potential for nonirrigated and irrigated cotton, grain sorghum, and wheat, and irrigated soybeans. Good management includes leaving residue on the surface when crops are not growing, using timely and limited tillage, and rotating crops. These practices conserve moisture and help to control soil blowing and water erosion. Residue also helps to maintain soil productivity. Occasionally emergency tillage is needed to roughen the surface and thus reduce the damage caused by soil blowing when crops and residue provide inadequate protection. A well designed surface or sprinkler irrigation system is essential. If irrigated, this soil needs to be fertilized.

The potential is medium for native range plants. Low rainfall produces moderate yields of short and mid grasses during favorable years. The potential is medium for wildlife habitat.

The potential is medium for most urban and recreational use. This soil is corrosive to uncoated steel, shrinks and swells as the moisture content changes, has low strength and slow water percolation, and is too clayey. Structures should be designed to withstand the adverse effects of these limitations.

Capability subclass IIIe nonirrigated and irrigated; Clay Loam range site.

32—Olton-Urban land complex, 0 to 2 percent slopes. This nearly level to gently sloping unit is on uplands. It occurs as irregularly shaped areas that range from 50 to 200 acres.

Olton soils make up about 65 percent of this unit, Urban land 30 percent, and other soils 5 percent.

The Olton soil is deep. The surface layer is friable, mildly alkaline, brown clay loam about 10 inches thick. From 10 to 18 inches is firm, mildly alkaline, brown clay loam. From 18 to 30 inches is firm, moderately alkaline, reddish brown clay loam. From 30 to 42 inches is firm, moderately alkaline, reddish brown clay loam that has a few visible films and threads of calcium carbonate. From 42 to 80 inches is friable, moderately alkaline clay loam that is pink in the upper 18 inches and yellowish red in the lower 20 inches.

Urban land consists of residential and commercial buildings, driveways, streets, sidewalks, parking lots, and airport runways.

The Olton soil is well drained and high in natural fertility. Surface runoff is high because of the amount of soil covered by structures, which shed most of the precipitation. Permeability is moderately slow, and available water capacity is high.

Included in mapping are small areas of Acuff, Amarillo, and Estacado soils. These included soils make up less than 10 percent of any one mapped area.

This unit is entirely in urban use. The Olton soil is used for lawn grasses, ornamental trees and shrubs, and flower and vegetable gardens.

This unit has medium potential for most urban and recreational use. The Olton soil is corrosive to uncoated steel, shrinks and swells as moisture content changes, is too clayey, and has slow water percolation. Well designed structures can withstand these problems. Small buildings often shift and crack if their foundations are not adequately designed, and pavement failures are common. The potential is medium for recreational use. The clay loam surface layer and slow percolation are the most restrictive features.

The potential is low for cropland, range, and wildlife habitat.

33—Portales loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands. It occurs as generally small, irregularly shaped areas on benches around playas. Areas range from 5 to 50 acres.

The surface layer is friable, moderately alkaline, dark grayish brown loam about 14 inches thick. From 14 to 36 inches is firm, moderately alkaline clay loam that is grayish brown in the upper 8 inches and light brownish gray in the lower 14 inches. From 36 to 60 inches is friable, moderately alkaline, white clay loam that is about 40 percent visible soft masses of calcium carbonate. From 60 to 80 inches is friable, moderately alkaline, light gray clay loam that is about 10 percent visible soft masses of calcium carbonate.

This soil is well drained. Surface runoff is very slow. Permeability is moderate, and available water capacity is high. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is slight. The hazard of soil blowing is moderate.

Included in some areas of this soil are spots of Arch, Drake, Mansker, and Zita soils. These included soils make up about 10 percent of some mapped areas.

This soil is used mainly as cropland. Some areas are in native range grasses. Cotton and grain sorghum are the main crops, but other crops can be grown.

The potential is medium for nonirrigated and irrigated cotton and nonirrigated grain sorghum and wheat. The

potential is high for irrigated grain sorghum and wheat. Careful management is needed to keep crop residue on the surface during critical periods of erosion. Residue management helps to control soil blowing and water erosion and conserves moisture. Residue also helps to maintain soil productivity. Occasionally, emergency tillage is needed to reduce the damage caused by soil blowing. If irrigated, this soil needs to be fertilized. A designed surface or sprinkler irrigation system and proper application of irrigation water are essential.

This soil has medium potential for native range plants. Low rainfall limits production. Native range plants are mainly short grasses, which produce a medium amount of forage. The potential is medium for wildlife habitat.

The potential is medium for most urban use. This soil has low strength, is corrosive to uncoated steel, and shrinks and swells with moisture changes. Good design and careful installation are needed if urban structures are to function satisfactorily. The potential is high for recreational use.

Capability subclass IIIe nonirrigated, and IIe irrigated; Loamy range site.

34—Posey fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands. It occurs as irregularly shaped areas that range from 10 to 200 acres. Local shifting of soil by wind is evident in some areas.

The surface layer is friable, moderately alkaline, brown fine sandy loam about 10 inches thick. From 10 to 25 inches is friable, moderately alkaline, brown sandy clay loam that has a few films and threads of calcium carbonate. From 25 to 40 inches is firm, moderately alkaline, reddish yellow sandy clay loam that has many films, threads, and concretions of calcium carbonate. From 40 to 60 inches is firm, moderately alkaline, reddish yellow sandy clay loam that has common films and threads of calcium carbonate.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and available water capacity is medium. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is slight. The hazard of soil blowing is moderate.

On about 20 percent of the acreage, this soil is more than 40 percent calcium carbonate between depths of 10 and 40 inches. Acuff, Amarillo, and Mansker soils are included in some areas. These included soils make up 5 percent or less of any one mapped area.

This soil is used mainly as cropland, but a few small areas are in native range. Cotton, grain sorghum, and wheat are the main crops.

The potential is medium for nonirrigated and irrigated cotton, grain sorghum, and wheat. Good management includes leaving residue on the surface when crops are not growing, using timely and limited tillage, and rotating crops. These practices conserve moisture and help to control soil blowing and water erosion. Residue also helps in maintaining soil productivity. Occasionally emergency tillage is needed to reduce the damage caused by soil blowing. A well designed surface or sprinkler irrigation system and proper application of irrigation water are essential. If irrigated, this soil needs to be fertilized.

This soil has high potential for native range plants, which are dominantly mid and short grasses. Some areas are in mesquite, yucca, and sandsage. Yields are good during favorable years. The potential is medium for wildlife habitat.

The potential is high for most urban use. This soil is corrosive to uncoated steel, but the risk of corrosion is easily overcome with good design. Other limitations are seepage from sewage lagoons or other water-holding structures. The potential is high for recreational use.

Capability subclass IIIe nonirrigated, IIe irrigated; Loamy range site.

35—Posey fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands along drainageways and around playas. It occurs as long areas that range from 10 to 100 acres. Local shifting of soils by wind is evident in some places.

The 6-inch surface layer is friable, moderately alkaline, brown fine sandy loam that contains a few cemented concretions of calcium carbonate. From 6 to 26 inches is friable, moderately alkaline, yellowish red sandy clay loam that is about 10 percent by volume soft masses of calcium carbonate and films and threads of calcium carbonate. From 26 to 42 inches is firm, moderately alkaline, pink sandy clay loam that is about 35 percent by volume soft masses, slightly cemented concretions, films, and threads of calcium carbonate. From 42 to 62 inches is firm, moderately alkaline, reddish yellow sandy clay loam that is about 10 percent by volume soft and slightly cemented calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are moderate.

On about 20 percent of the acreage, this soil is more than 40 percent calcium carbonate between depths of 10 and 40 inches. Spots of Amarillo and Mansker soils are included in some areas. These included spots make up less than 5 percent of any one mapped area.

This soil is used as cropland. A few small areas are in native range plants. Grain sorghum, wheat, and cotton are the main crops.

The potential is medium for nonirrigated and irrigated cotton, grain sorghum, and wheat. Good management includes leaving residue on the surface when crops are not growing, using timely and limited tillage, and rotating crops. These practices conserve moisture and help to control water erosion and soil blowing. Residue helps in maintaining productivity. Occasionally emergency tillage is needed to reduce the damage caused by soil blowing. A well designed surface or sprinkler irrigation system and proper application of irrigation water are essential. If irrigated, this soil needs fertilizer.

This soil has high potential for native range plants. During favorable years, good yields of mid and short

grasses are produced. The potential is medium for wildlife habitat.

The potential is high for most urban use. The soil is corrosive to uncoated steel, but this limitation is easily overcome. Sewage lagoons are moderately limited by seepage. The potential is high for recreational use. For playgrounds, however, some areas are moderately limited by slope.

Capability subclass IIIe nonirrigated, IIIe irrigated; Loamy range site.

36—Posey fine sandy loam, 3 to 5 percent slopes. This deep, gently sloping soil is on uplands along draws and around playas. It occurs as long areas that range from 20 to 300 acres. Local shifting of soil by wind is evident in some places.

The surface layer is friable, moderately alkaline, reddish brown fine sandy loam about 10 inches thick. From 10 to 18 inches is friable, moderately alkaline, reddish brown sandy clay loam that has a few masses, films, and threads of calcium carbonate. From 18 to 39 inches is firm, moderately alkaline, light reddish brown sandy clay loam that is about 40 percent soft masses and concretions of calcium carbonate. From 39 to 80 inches is firm, moderately alkaline, reddish yellow sandy clay loam that is about 10 percent by volume weakly cemented concretions and soft masses of calcium carbonate (fig. 12).

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is severe. The hazard of soil blowing is moderate.

On about 20 percent of the acreage, this soil is more than 20 percent calcium carbonate between depths of 10 and 40 inches. Included in some areas are small areas of Mansker soil. These included soils make up less than 10 percent of any one mapped area.

This soil is used mainly as range, but some areas are used as cropland. Wheat is the main crop, but other crops can be grown.

The potential is low for nonirrigated and irrigated grain sorghum and wheat. Good management includes leaving residue on the surface when crops are not growing, using timely and limited tillage, and rotating crops. These practices conserve moisture and help to control soil blowing and water erosion. Residue also helps in maintaining productivity. Terraces are needed to help control water erosion and conserve moisture. Occasionally, emergency tillage is needed to help reduce the damage caused by soil blowing. A well designed sprinkler irrigation system and fertilizer are essential if this soil is irrigated.

This soil has high potential for native range plants. Native range plants are mainly short and mid grasses, which produce high yields of forage during favorable years. The potential is medium for wildlife habitat.

This soil has high potential for most urban use. Slope limits its use as a site for small commercial buildings and sewage lagoons. The potential is high for most recreational use. Slope is a limitation for playgrounds.

Capability subclass IVe nonirrigated and irrigated; Loamy range site.

37—Posey fine sandy loam, 5 to 8 percent slopes. This deep, sloping soil is on uplands along draws and around playas. It occurs as long areas that range from 5 to 100 acres. Local shifting of soil by wind is evident in some places.

The 6-inch surface layer is friable, moderately alkaline, reddish brown fine sandy loam. From 6 to 18 inches is friable, moderately alkaline, yellowish red sandy clay loam that has a few masses, films, and threads of calcium carbonate. From 18 to 38 inches is firm, moderately alkaline, red sandy clay loam that is about 40 percent by volume soft masses, films, and threads of calcium carbonate. From 38 to 72 inches is firm, moderately alkaline, yellowish red sandy clay loam that is about 10 percent by volume slightly cemented and soft calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and available water capacity is medium. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is severe. The hazard of soil blowing is moderate.

On about 20 percent of the acreage, this soil is more than 40 percent calcium carbonate between depths of 10 and 40 inches. Included are spots of Mansker soils that make up as much as 3 percent of some mapped areas.

This soil is used as range. It is not suitable as cropland because of excess slope.

The potential is high for native range plants. Mid and short grasses are the main native range plants. Yields of forage are high during favorable years. Good range management includes keeping a sufficient plant cover on the soil to prevent water erosion and soil blowing. The potential is medium for wildlife habitat.

The potential is low for most urban use. Slope limits this soil as a site for small commercial buildings and sewage lagoons. Seepage also limits its suitability for sewage lagoons. The potential is high for most recreational use. Slope limits the suitability of this soil as a site for playgrounds.

Capability subclass VIe nonirrigated; Loamy range site.

38—Potter loam, 2 to 12 percent slopes. This very shallow to shallow, gently sloping to strongly sloping soil is on uplands. It occurs as long, irregularly shaped areas that range from 10 to 150 acres.

This soil is about 12 inches thick over slightly platy white caliche (fig. 13). The 5-inch surface layer is friable, moderately alkaline, grayish brown loam that has a few caliche fragments and concretions of calcium carbonate. From 5 to 12 inches is friable, moderately alkaline, pale brown loam that has concretions of calcium carbonate and caliche fragments. From 12 to 18 inches is white platy caliche. At a depth of 18 to 30 inches is white loamy material that is about 60 percent caliche fragments.

This soil is well drained. Surface runoff is medium to rapid. Permeability is moderate, and available water capacity is very low. The root zone is very shallow to

shallow, but plant roots penetrate the caliche layer through fracture planes. The hazard of water erosion is severe. The hazard of soil blowing is slight.

Included in some areas of this soil are spots of Berda, Kimbrough, Mansker, and Posey soils, which make up less than 15 percent of any one mapped area.

This soil is used as range. It is not suitable as cropland because it is too shallow and has steep slopes.

The potential is low for native plants. The soil is very shallow and has low available moisture. Native range plants are mainly short grasses, which produce only low yields of forage during favorable years. Good management includes keeping a plant cover on the surface to protect the soil against water erosion. The potential is also low for wildlife habitat.

The potential is dominantly medium for most urban use, but it is low in areas where slopes are more than 7 percent. Septic tank absorption fields have low potential because of seepage. The potential is high for most recreational use if slopes are 8 percent or less. The potential is medium on steeper slopes. The potential for playgrounds is medium on slopes up to 6 percent but is low on steep slopes.

Capability subclass VIIs, nonirrigated; Very Shallow range site.

39—Potter-Berda association, steep. The steep, very shallow to deep soils of this association are on uplands. Slopes are complex, concave, and convex and range from 20 to 45 percent; 10- to 15-foot vertical cliffs are common. Mapped areas are long and nearly continuous. They occupy escarpments and foot slopes along both sides of the North Fork Double Mountain Fork Brazos River.

Potter soils make up about 55 percent of this association, Berda soils about 35 percent, and other soils 10 percent. The delineations of this association are much larger and the composition more variable than those of most other map units in the county. Mapping was controlled well enough, however, for the anticipated use of the areas.

Potter soils occupy convex surfaces near the top of the slope. In a few places they are on knobs at lower elevations. They are about 4 inches thick over pinkish white, slightly platy caliche that is soft enough to be cut with a spade. The 4-inch surface layer is friable, moderately alkaline, pinkish gray loam that has many concretions of calcium carbonate and many fragments of caliche up to 5 centimeters in diameter.

Potter soils are well drained. Surface runoff is rapid. Permeability is moderate. Available water capacity is very low. Fertility is low. Susceptibility to water erosion is severe. The hazard of soil blowing is slight.

Berda soils occupy the less sloping concave positions on the lower part of the slope. The surface layer is very friable, moderately alkaline, brown loam about 8 inches thick. From 8 to 24 inches is very friable, moderately alkaline, pale brown loam that has many hard caliche fragments and films and threads of calcium carbonate. From 24 to 48 inches is friable, moderately alkaline, pale brown loam that is about 3 percent visible concretions of calcium carbonate. From 48 to 60 inches is friable, moderately alkaline, pink loam that has only a few concretions of calcium carbonate.

Berda soils are well drained. Surface runoff is medium, and permeability is moderate. Available water capacity is medium. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is severe. The hazard of soil blowing is moderate.

Included in mapping are small areas of Mobeetie soils and rock outcrop. These included spots make up less than 15 percent of any one mapped area.

This association is used for range and recreation. It is not suited to crops.

The potential is low for native range plants. It is limited by low rainfall, slope, and low available moisture. Only low yields of mid and short grasses are produced during favorable years. Good management is needed to keep a plant cover on the soil to control water erosion and soil blowing. The potential is low for wildlife habitat.

The potential is low for most urban and recreational use because of excess slope.

Potter soil in capability subclass VIIs, Very Shallow range site; Berda soil in capability subclass VIe, Rough Breaks range site.

40—Potter-Kimbrough-Urban land complex, 1 to 5 percent slopes. This unit consists of very shallow to shallow, gently sloping soils on uplands. It occurs as long, irregularly shaped areas that range from 10 to 50 acres. It is about 50 percent Potter soils, 15 percent Kimbrough soils, 30 percent Urban land, and 5 percent other soils.

Potter soils are about 12 inches thick over slightly platy, white caliche. The surface layer is friable, moderately alkaline, grayish brown loam about 5 inches thick. It has many small caliche fragments and concretions of calcium carbonate. From 5 to 12 inches is friable, moderately alkaline, pale brown loam that has only a few concretions of calcium carbonate and caliche fragments.

Kimbrough soils are about 11 inches thick over pinkish white indurated caliche. The 11-inch surface layer is friable, moderately alkaline, brown loam. About 20 percent of the surface is covered with hard caliche fragments.

Urban land consists of works and structures, mainly commercial buildings, streets, parking lots, sidewalks, and paved alleys. Some residential areas are included.

The soils of this unit are well drained. Runoff is high because of the works and structures that shed precipitation. Permeability is moderate, and available water capacity is very low. Natural fertility is low. Susceptibility to water erosion is severe.

Included in some areas are Acuff, Amarillo, and Estacado soils. These inclusions make up less than 5 percent of any one mapped area.

This unit is entirely in urban use. Where landscaping is done, topsoil generally is added so that ornamental vegetation grows satisfactorily.

The potential is medium for most urban use. Small stones on the surface and shallow depth to hard caliche

are the main limitations for most urban use. The potential is high for most recreational use. Small stones on the surface and slopes of more than 2 percent limit the potential of this unit as a site for playgrounds.

The potential is low for cropland and range.

41—Pullman clay loam, 0 to 1 percent slopes. This deep, nearly level soil is on uplands. It occurs as irregularly shaped areas that range from 25 to several hundred acres.

The surface layer is friable, mildly alkaline, brown clay loam about 12 inches thick. From 12 to 34 inches is firm, moderately alkaline, brown clay. From 34 to 46 inches is firm, moderately alkaline, reddish brown clay that has a few films, threads, and soft masses of calcium carbonate. From 46 to 66 inches is friable, moderately alkaline, pink clay that is about 30 percent by volume soft powdery calcium carbonate. From 66 to 80 inches is friable, moderately alkaline, reddish yellow clay that is about 15 percent by volume calcium carbonate (fig. 14).

This soil is well drained. Surface runoff is slow. Permeability is very slow, and available water capacity is high. The root zone is deep, but clay layers tend to impede the movement of air, water, and roots. The hazards of water erosion and soil blowing are slight.

On about 10 percent of the acreage, this soil has a dark colored surface layer less than 20 inches thick. Areas of Olton, Lofton, Randall, and Estacado soils are included in some areas. Included soils make up less than 10 percent of any one mapped area.

This soil is used mainly as cropland, but a few small areas are in native range. Cotton and grain sorghum are the main crops, but other crops can be grown.

The potential is medium for nonirrigated cotton, grain sorghum, wheat, and soybeans. If the soil is irrigated, the potential is high for these crops. Keeping crop residue on or near the surface conserves soil moisture and helps to protect the soil from water erosion and soil blowing. Fertilizer is needed if the soil is irrigated. A designed irrigation system and proper application of irrigation water are essential. Sprinkler irrigation is not well suited to this soil.

The potential is medium for native range plants. Moderate yields of short and mid grasses are produced during favorable years. The potential is medium for wildlife habitat.

The potential is low for most urban use. This soil is too clayey, is corrosive to uncoated steel, shrinks and swells with moisture change, and has low strength. Expensive structure design is needed to overcome these problems. The soil is well suited to sewage lagoons and other water-holding earthen structures. The potential is medium for most recreational use.

Capability subclass IIIe nonirrigated, IIs irrigated; Clay Loam range site.

42—Randall clay. This deep, nearly level soil is at the bottoms of playas or in shallow depressions. Slopes are 0 to 1 percent. The surrounding plains range from 2 to 20 feet higher in elevation than the playa bottoms. Mapped areas are circular to oval in shape and range from 10 to 75 acres. In undisturbed areas, the surface is characterized by gilgai microrelief, that is, microknolls and microdepressions. The microknolls are 6 to 20 inches higher than the bottoms of the microdepressions. They are 2 to 10 feet across and from 5 to 15 feet apart. Evidence of gilgai microrelief is destroyed after a few years of cultivation (fig. 15).

In the center of a microknoll, the surface layer is firm, moderately alkaline, very dark gray clay about 20 inches thick. This layer changes gradually to very firm, moderately alkaline, dark gray clay that is about 18 inches thick and has a few slickensides. From 38 to 62 inches is very firm, moderately alkaline, dark grayish brown clay that has a few concretions of calcium carbonate.

This soil is somewhat poorly drained. Surface runoff is ponded. After rains, runoff from surrounding soils covers this soil. Water a few inches to several feet deep stands for periods of a few days to several weeks. When dry, this soil has wide, deep cracks that extend to the surface. Water enters the soil rapidly when it is cracked but very slowly when it is wet and cracks are sealed. Permeability is very slow. Available water capacity is medium. The root zone is deep, but the clay content tends to impede the movement of air, water, and roots. The hazard of water erosion is slight. The hazard of soil blowing is moderate.

Included in some areas of this soil are small areas of Lofton, Portales, and Zita soils. Also included are a few areas where the surface layer is lighter colored. These included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as range and wildlife habitat, but a few areas are cultivated. Nonirrigated cotton, grain sorghum, and wheat are the main crops. This soil is not suitable for irrigation.

The potential is low for nonirrigated cotton and grain sorghum and medium for nonirrigated wheat. Keeping crop residue on the surface conserves moisture and helps to prevent soil blowing. It also helps to improve tilth and water intake. In dry years, emergency tillage is needed to help control soil blowing when crop residue furnishes inadequate protection. Farming is hazardous because crops are sometimes drowned out. Surface drainage is needed.

This soil has high potential for native range plants. It is droughty between periods of excess water. Good yields of forage, however, can be obtained during favorable years. The potential is low for wildlife habitat.

The potential is low for most urban use. Flooding, shrinking and swelling with changes in moisture content, low strength, and the risk of corrosion to uncoated steel are the most restrictive features. The potential is low for recreational use, mainly because of flooding and the clay surface layer.

Capability subclass VIw nonirrigated, IVw nonirrigated if drained; Lakebed range site.

43—Randall Variant fine sandy loam. This deep, nearly level soil is at the bottoms of playas. Slopes are 0 to 1 percent. The surrounding plains range from 2 to 20 feet higher in elevation than the playa bottom. Mapped areas are circular or oval in shape and range from 5 to 20 acres.

The surface layer is friable, moderately alkaline, reddish brown and brown fine sandy loam about 20 inches thick. From 20 to 50 inches is firm, moderately alkaline, dark gray clay. From 50 to more than 80 inches is very firm, moderately alkaline, gray clay that has a few soft masses and concretions of calcium carbonate.

This soil is somewhat poorly drained. Surface runoff is ponded. Runoff from surrounding soils covers this soil after heavy rains. Water a few inches to several feet deep stands for periods of a few hours to several days. Available water capacity is medium. Permeability is very slow. The root zone is deep, but clay layers tend to impede the movement of air, water, and roots. The hazard of water erosion is slight. The hazard of soil blowing is moderate.

About 15 percent of the acreage is included areas of Lofton clay loam that is as much as 15 inches of fine sandy loam at the surface. Also included are spots of Amarillo, Portales, Posey, and Zita soils. These included soils make up less than 10 percent of any one mapped area.

Most of the acreage is range, but a few areas are cultivated. Nonirrigated cotton, grain sorghum, and wheat are the main crops. Irrigation is not suitable on this soil.

The potential is low for nonirrigated cotton and medium for nonirrigated grain sorghum and wheat. Keeping crop residue on or near the surface helps to prevent soil blowing. It also conserves moisture and improves tilth and water intake. In dry years, emergency tillage is needed to help control soil blowing when crop residue furnishes inadequate protection. Farming is hazardous because crops are sometimes drowned out.

This soil has high potential for native range plants. It is droughty between periods of excess moisture. Good yields of forage, however, can be obtained during favorable years. The potential is low for wildlife habitat.

The potential is low for most urban use. Flooding, shrinking and swelling with changes in moisture content, low strength, and the risk of corrosion to uncoated steel are the most restrictive features. The potential is low for recreational use. Wetness is the most restrictive feature.

Capability subclass IVs nonirrigated; Lakebed range site.

44—Urban land. Urban land is on nearly level uplands. Slopes are 0 to 1 percent. Only one area, which includes downtown Lubbock, was mapped. This is a rectangular area of about 350 acres.

Urban land consists of works, structures, and disturbed areas that have altered or obscured the soil so that classification is not practical. It is 75 to 90 percent office buildings, retail stores, warehouses, streets, parking lots, sidewalks, paved alleys, and railroads. Most areas of uncovered soil are severely altered. In some areas the soil has been hauled in so that ornamental vegetation can be established and maintained.

45—Zita fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on benches adjacent to playas. It occurs as curved areas that range from 5 to 50 acres. Local shifting of soil by wind is evident in some places.

The surface layer is very friable, mildly alkaline, brown fine sandy loam about 10 inches thick. From 10 to 18 inches is friable, mildly alkaline, dark brown loam. From 18 to 27 inches is friable, moderately alkaline, brown clay loam. From 27 to 38 inches is friable, moderately alkaline, light brown clay loam that has a few weakly cemented concretions of calcium carbonate. From 38 to 54 inches is friable, moderately alkaline, pinkish gray clay loam that is about 35 percent by volume soft masses of calcium carbonate. From 54 to 62 inches is firm, moderately alkaline, very pale brown clay loam that has many weakly cemented concretions of calcium carbonate.

This soil is well drained. Surface runoff is very slow. Permeability is moderate, and available water capacity is medium. The root zone is deep and is easily penetrated by plant roots. The hazard of water erosion is slight. The hazard of soil blowing is moderate.

About 10 percent of the acreage is included areas of Portales loam. Also included are spots of Lofton and Randall soils. These included soils make up less than 5 percent of any one mapped area.

All areas of this soil are cultivated. Cotton and grain sorghum are the main crops, but other crops can be grown.

The potential is high for nonirrigated and irrigated cotton, grain sorghum, and wheat, and irrigated soybeans. Good management includes leaving residue on the surface when crops are not growing, using timely and limited tillage, and rotating crops. These practices conserve moisture and help to control soil blowing and water erosion. Residue also helps in maintaining soil productivity. Occasionally, emergency tillage is needed to roughen the soil surface and thus reduce the damage caused by soil blowing when crops and residue provide inadequate protection. A well designed irrigation system and proper application of irrigation water are essential if this soil is irrigated. Either surface or sprinkler irrigation can be used. If irrigated, this soil needs to be fertilized.

This soil has high potential for native range plants. Native range plants are mainly short and mid grasses, which produce high yields of forage during favorable years. The potential is medium for wildlife habitat.

This soil has medium potential for most urban use. It is corrosive to uncoated steel and has low strength. Urban structures must be designed to overcome these limitations if they are to function satisfactorily. The potential is high for most recreational use.

Capability subclass IIIe nonirrigated, IIe irrigated; Sandy Loam range site.

46—Zita loam, 0 to 1 percent slopes. This deep, nearly level soil is on benches adjacent to playas. It occurs as curved areas that range from 10 to 30 acres.

The top 12 inches of this soil is friable, moderately alkaline, dark grayish brown loam. From 12 to 19 inches is friable, moderately alkaline, brown clay loam. From 19 to 28 inches is friable, moderately alkaline, grayish brown clay loam that has a few visible threads of calcium carbonate. From 28 to 36 inches is friable, moderately alkaline, light brownish gray clay loam that has common visible films and threads and few soft masses of calcium carbonate. From 36 to 66 inches is friable, moderately alkaline, white clay loam that is about 60 percent by volume soft calcium carbonate in the upper 18 inches and about 10 to 15 percent below.

This soil is well drained, but surface runoff is very slow. Permeability is moderate, and available water capacity is medium. The root zone is deep and is easily penetrated by plant roots. The hazards of water erosion and soil blowing are slight.

About 15 percent of some areas of this soil is included areas of Portales soil. About 5 percent is a soil that is similar to the Zita soil but is more clayey between 10 and 30 inches. Also included are spots of Lofton soils that make up less than 5 percent of any one mapped area.

Most areas of this soil are cultivated. Cotton and grain sorghum are the main crops, but other crops can be grown.

The potential is high for nonirrigated and irrigated cotton, grain sorghum, and wheat, and irrigated soybeans. Good management includes leaving residue on the surface when crops are not growing, using timely and limited tillage, and rotating crops. These practices conserve moisture and help to control soil blowing and water erosion. Residue also helps in maintaining soil productivity. Occasionally, emergency tillage is needed to roughen the surface and thus reduce the damage caused by soil blowing when crops and residue provide inadequate protection. A well designed irrigation system and proper application of irrigation water are essential. Either surface or sprinkler irrigation can be used. If irrigated, this soil needs to be fertilized.

The potential is medium for native range plants because of low available moisture during the growing season. Native range plants are mainly short grasses, which produce a medium amount of forage. The potential is medium for wildlife habitat.

This soil has medium potential for most urban use. It is corrosive to uncoated steel and has low strength. Urban structures must be designed to overcome these limitations. The potential is high for recreational use.

Capability subclass IIIe nonirrigated, IIe irrigated; Clay Loam range site.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and range, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities; and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Cultivated crops

The major concerns in managing the soils for cultivated crops are considered in the paragraphs that follow. Irrigation is briefly discussed. The system of land capability classification used by the Soil Conservation Service is explained. Predicted yields of the main crops grown in Lubbock County are listed in table 4.

This section provides information on the overall agricultural potential and needed practices in the survey area for those in the agribusiness sector—equipment dealers, earth moving contractors, fertilizer companies, processing companies, planners, conservationists, and others. Information on management is given for each soil mapped in the county in the section "Soil maps for detailed

planning." In planning management for an individual field or farm check the detailed information in the description of each soil.

In 1967, about 469,416 acres in the survey area was used for cropland, according to the Conservation Needs Inventory (*6*).

The most restrictive factor for cultivated crops is low rainfall. The potential of the soils for increased production of food is high, but the lack of rainfall and irrigation water limits production during most years.

Other management concerns are the hazards of water erosion and soil blowing.

Water erosion is a hazard on the loamy, gently sloping Acuff, Amarillo, Berda, Estacado, Mansker, Midessa, Olton, and Posey soils. Runoff can damage these soils unless they are protected. A plant cover and mechanical measures, such as contour farming, terraces, and grassed waterways, can minimize the risk of water erosion.

Soil blowing is a severe hazard on Amarillo loamy fine sand. It is a moderate hazard on the loamy Amarillo, Arch, Bippus, Drake, Estacado, Midessa, Mansker, Mobeetie, Portales, Posey, and Zita soils and the clayey Randall soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining a plant cover, a surface mulch, or a rough surface through proper tillage minimizes the risk of blowing.

Loss of the surface layer by water erosion or soil blowing is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Second, water erosion on farmland results in sediment entering streams. Controlling water erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use and recreation and for fish and wildlife. Soil blowing results in air pollution. It also deposits drifts of productive soil material along fence rows, in ditches, and across roads.

Erosion control provides a protective surface cover, reduces runoff, and increases infiltration. A cropping system that keeps a plant cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils.

Minimum tillage and crop residue on or near the surface increase infiltration and reduce the hazards of runoff and erosion. Both can be adapted to most soils in the survey area but are more difficult on the soils that have a clayey surface layer, for example, Olton and Pullman soils.

Deep plowing increases the clay content of the surface layer of Amarillo loamy fine sands. An increase in clay content in the surface layer of these sandy soils reduces the hazard of soil blowing.

Emergency tillage helps in controlling soil blowing if the crop residue does not furnish adequate protection. It roughens the surface so that the material is less likely to blow. Acuff, Amarillo, Arch, Berda, Bippus, Drake, Estacado, Midessa, Olton, Posey, Portales, Randall, and Zita soils are suitable for emergency tillage.

Contour farming, also an erosion control practice in the survey area, is best adapted to soils of smooth uniform slopes, for example, to most areas of the gently sloping Acuff, Amarillo, Berda, Estacado, Mansker, Midessa, Olton, and Posey soils.

Grassed waterways minimize soil erosion by carrying runoff. They are also good outlets for terraces or diversions.

Terraces and diversions reduce the length of slope and thus reduce the risk of runoff and erosion. They are most practical on deep, well drained soils that have regular slopes. Acuff, Amarillo, Arch, Midessa, Berda, Estacado, Olton, and Pullman soils are suitable for terraces. The other soils are less suitable for terraces and diversions because of the high concentration of calcium carbonate within a depth of 30 inches as in Mansker soils and Posey soils, or because of the indurated caliche within a depth of 30 inches, as in Friona soils.

Information on the design of erosion control practices for each kind of soil is available in the local office of the Soil Conservation Service.

Soil fertility is naturally medium to high in most of the cultivated soils on uplands in the survey area. Additions of fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer to be applied. None of the soils require additions of lime.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils that have good tilth are granular and porous.

Most of the soils used for cultivated crops in the survey area are loamy and can be plowed in fall. Some of the gently sloping loamy soils, however, are subject to damaging water erosion if they are plowed in fall. Maintaining residue on the soil surface is important for those soils subject to soil blowing.

Olton, Pullman, Lofton, and Randall soils contain significant amounts of clay. Tilth is therefore a problem. If wet when plowed, these soils tend to be very cloddy when dry and a good seedbed is difficult to prepare. Fall plowing generally results in good tilth in spring. Soil blowing is a problem if the soils are left bare.

Field crops suited to the soils and climate of the survey area are cotton, grain sorghum, soybeans, and wheat. Cotton, grain sorghum, and soybeans are row crops. Wheat is a close-growing crop.

Special crops are mainly vegetables and nursery plants. Deep soils that have good natural drainage and that warm up early in spring are especially well suited to many vegetables. Production is limited mainly by the amount of rainfall, the fertility, and the availability of irrigation water.

The latest information and suggestions on growing field crops or special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Irrigation

Irrigation is important in Lubbock County. In 1974, approximately 295,000 acres was irrigated. The larger irrigated acreage is in the northern half of the county.

All water used for irrigation is pumped from wells. The average depth of the wells is about 130 feet. These wells vary in production, ranging from 20 to 850 gallons per minute.

Both surface irrigation and sprinkler irrigation are used. In some places, land leveling or land smoothing is necessary before a surface irrigation system can be installed. Row irrigation is the main method of application on the nearly level clayey and loamy soils. Sprinklers are used on the gently sloping loamy soils and the nearly level to gently sloping sandy soils. If a surface system is used on the gently sloping loamy soils, bench leveling is needed.

Yields of irrigated crops are two to three times greater than the yields of nonirrigated crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland or for engineering purposes.

In the capability system, all kinds of soil are grouped at two levels: capability class and subclass. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production. (None in the county).

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is indicated in table 3. All soils in the survey area except those named at a level higher than the series are included. Some of the soils that are well suited to cultivated crops, for example, soils in capability classes II and III are now used for urban land. Data in this table can be used to determine the farming potential of such soils.

The capability subclass is identified in the description of each soil map unit in the section "Soil maps for detailed planning."

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 4. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil or that a given crop is not commonly irrigated.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. A few farmers may be obtaining average yields higher than those shown in table 4.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties;

appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown; that good quality irrigation water is uniformly applied in proper amounts as needed; and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 4 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Range

JOE B. NORRIS, range conservationist, Soil Conservation Service, helped prepare this section.

Range is land on which the natural plant community consists of grasses, forbs, and shrubs valuable for grazing. About 15,203 acres in the county was used for range in 1967, according to the Conservation Needs Inventory (*6*). This acreage was used for the production of native vegetation and was grazed by domestic livestock and wildlife. Since the inception of irrigation on the High Plains, ranching has been confined to about five units on the land below the "caprock" escarpment. Small plots of range occur throughout the rest of the county, but none are large enough to constitute an economical unit.

All of the soils of the county produce a mixture of plants suitable for grazing by livestock. Cattle are the main animals grazed. A few deer and antelope make up the wildlife population.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 5 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of predominant grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 5.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction and salt content are also important.

Potential production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Common plant names are given for grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The soils of the rolling land below the "caprock" escarpment in the southeastern part of the county produce a mixture of medium and short grasses and some forbs and woody plants. Mesquite has increased and invaded on the

deeper soils. The shallow soils of the slopes produce low yields of mostly short grasses and a few forbs. The clay loams in the northeastern part of the county produce mostly short grasses, a few forbs, and woody plants. The fine sandy loams and loams of the southern and western parts of the county produce a mixed vegetation of medium and short grasses and forbs. Mesquite increases and invades on these deep soils.

Growth of native vegetation is greatest during May and June when temperatures and rainfall are favorable. Another period of growth usually occurs during September and October. The fertile bottoms of draws produce both cool and warm season grasses, which are of particular value for yearlong forage production. Livestock sales are the only way range products are marketed in the county. The success of the stockman depends largely upon how successfully he keeps the soil productive of good forage plants. Factors to be considered are the time and intensity of grazing and the needed practices that permit re-establishment of the natural plant community of each soil.

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 6 shows, for each kind of soil, the degree and kind of limitations for building site development; table 7, for sanitary facilities; and table 9, for water management. Table 8 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 6. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special

planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, and open ditches. Such digging or trenching is influenced by the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 6 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 6 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, and shrink-swell potential are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 7 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is

above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 7 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 8 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 13 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 8 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 13.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture

and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 9 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitations are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the specified use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 7, and interpretations for dwellings without basements and for local roads and streets, given in table 6.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains

firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, sorghum, wheat, oats, barley, millet, buckwheat, cowpeas, soybeans, and sunflowers.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bluegrass, lovegrass, switchgrass, timothy, orchardgrass, trefoil, bromegrass, clover, alfalfa, and crownvetch.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, indiangrass, goldenrod, beggarweed, milkvetch, wheatgrass, fescue, partridgepea, and grama.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are agarito, lotebush, sumac, and fourwing saltbush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, cordgrass, and cattail and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are playas, waterfowl feeding areas, wildlife watering developments, and other ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, scaled quail, pheasant, meadowlark, dove, field sparrow, killdeer, cottontail rabbit, red fox, and coyote.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, and rails.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include jackrabbit, antelope, white-tailed deer, coyote, dove, chukar, scaled quail, sage grouse, wild turkey, meadowlark, and lark bunting.

Windbreaks and environmental plantings

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field, the interval depending on erodibility of the soil. They protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Table 12 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 12, based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Soil properties

Extensive data about soil properties are summarized on the following pages. The main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses were not conducted for any soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 13 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 13 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 13 in the standard terms used by the U.S. Department of Agriculture (*7*). These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in

diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 13. Also in table 13 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 14 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if

the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Erosion factors are in an equation that predicts the amount of soil loss resulting from rainfall erosion of cropland. The soil-loss prediction procedure is outlined by the U.S. Department of Agriculture, Agricultural Research Service (*8*), and is useful to guide the selection of practices for soil and water conservation. The soil erodibility factor "K" is a measure of the rate at which a soil will erode when other factors affecting erosion are constant. Soil-loss tolerance "T", sometimes called permissible soil loss, is the maximum rate of soil erosion that will permit a high level of crop productivity to be sustained economically and indefinitely.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 15 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams and with runoff from adjacent slopes. Water standing for short periods after rains or after snow melts is not considered flooding. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to

flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Cemented pans are hard subsurface layers, within a depth of 5 or 6 feet, that are strongly compacted (indurated). Such pans cause difficulty in excavation. The hardness of pans is similar to that of bedrock. A rippable pan can be excavated, but a hard pan generally requires blasting.

Town and country planning

The residential subdivision development in Lubbock County and the accompanying extension of public utilities create a need for soil information that differs somewhat from the information needed for farming. Many people need soil information for individual residential tracts that are well beyond public utilities.

Land appraisers, realtors, city planners, builders, and individuals need to have facts that will help them to know what sites are suitable for homes or other buildings and what areas should be reserved for other uses. Most soil properties that are important for town and country planning are also important for engineering. See the sections "Engineering" and "Soil properties" for information on soil interpretations and properties. Information in the engineering section, however, does not eliminate the need for more detailed onsite study if the soils are to be used for intensive purposes. Some lots have inclusions of contrasting soils that are too small to show separately on the soil map.

This section briefly discusses the importance of site selection, soils that have potential foundation problems, considerations for sewage disposal systems, corrosion problems of underground utility lines, and control of erosion and runoff. Also discussed is the use of soils for gardening and landscaping and the influence of soils on public health.

Site selection

In selecting a site for the construction of urban works and structures, the soil should be carefully investigated. Planners, builders, and maintenance men have met costly failures that can be traced to mistakes made in selecting soils for proposed structures. If the soil is poorly suited to the intended use, little change can be made without great expense. In some areas a structure can be designed to withstand the limitations of the soil. The problem, however, must be recognized before construction.

One of the first considerations is whether the soil is subject to flooding. The alluvial Bippus soils are subject to occasional or frequent flooding. They should not be considered as sites for permanent structures. Areas of these soils should be reserved for greenbelts, sound barriers, wildlife habitat, and recreational use, such as hike and bike trails or picnicking. Randall soils are subject to flooding and ponding for extended periods and should not be used for urban works and structures.

Other factors that affect site selection are soil permeability, available water capacity, drainage, soil reaction (pH), shrink-swell potential, risk of corrosion to steel and concrete, hydrologic classification, suitability as septic tank absorption field, suitability as sites for foundations and low cost streets and roads, erosion and runoff problems, potential for recreational use, suitability for growing grasses, flowers, vines, shrubs, and trees, and the influence of the soil on overall general health of residents. Many soil properties are described in detail in the sections "Town and country planning" and "Engineering properties." The more important properties are described in the following paragraphs.

Foundations

Special attention is needed in selecting sites for foundations. In some parts of the county are areas of soils that tend to shrink and swell with moisture changes. This ac-

tion creates such pressure that walls and foundations crack unless they are specially reinforced; some crack even if they are specially reinforced. This change in volume in a soil material as moisture content changes is called shrink-swell potential (see table 14). The soils most likely to cause damage are Pullman, Lofton, Olton, and Randall.

Soils likely to swell and shrink enough to damage foundations are those that have a high liquid limit and high plasticity index, or those classified as CH in the Unified System of Classification. See table 13 for estimated engineering properties and classifications. See also table 6, where soils are rated for building development.

Other considerations for foundations are flooding, ponding, low strength, or high corrosion potential.

Sewage disposal systems

Many new houses are built annually beyond existing municipal sewer lines. These areas must have onsite sewage disposal systems. The effectiveness of these systems depends largely on the absorptive capacity, permeability, percolation rate, wetness, flooding, seepage, and slope of the soils within the filter field (*2*).

The soils of Lubbock County, in general, are only slightly limited as sites for septic tank absorption fields.

In table 7, the soils are rated for sanitary facilities. By using the soil map to identify the soils and then referring to the ratings in table 7, it is generally possible to determine how well a septic tank system will function in a selected area. Nevertheless, it is advisable to make a detailed inspection of the soils at the exact site that is to be used as a filter field.

Underground utility lines

Water mains, gas pipelines, communication lines, and sewer pipes that are buried in the soil may corrode and break unless protected against certain electrobiochemical reactions resulting from the inherent properties of the soil.

All metals corrode to some degree when buried in the soil. Some metals corrode more rapidly in some soils than in others. The corrosion potential depends on the physical, chemical, electrical, and biological characteristics of the soil. For example, concentrations of oxygen, concentrations of anaerobic bacteria, moisture content, and external factors, such as manmade electrical currents, influence corrosion potential. Design and construction also have an influence. Occasionally, corrosion is intensified by connecting two dissimilar metals, by burying metal structures at varying depths, and by extending pipelines through different kinds of soils.

Control of water erosion, runoff, and soil blowing

During urban construction the natural vegetation is generally removed and large areas are covered with pavement, concrete, and buildings. The amount of runoff from construction areas generally increases and the pattern of runoff changes. Runoff after a heavy rain may be several times as great as when the same land was used for farming. The runoff concentrates in streets and gutters, instead of flowing into natural waterways, and the result is flooding, erosion, and deposition of sediments on lower lying areas. See table 9.

Soil blowing around construction sites can be very severe unless proper control measures are used. Bare soil is constantly disturbed by vehicular movement and other activities of construction.

The control of runoff, erosion, and soil blowing should begin at the planning and design stage before plans become fixed and construction begins. In good development planning, the problems brought on by soil erosion, runoff, and sedimentation can usually be avoided or lessened (*3*).

There are two kinds of erosion and sediment control measures—mechanical and vegetative.

Some mechanical measures used to reshape the land to intercept, divert, convey, retard, or otherwise control water erosion and runoff are—

1. *Land grading.*—Grade only those areas under immediate construction, as opposed to grading the entire site. Avoid leaving a large area bare and unprotected by vegetation.
2. *Bench terraces.*—Construct bench terraces across the slope and fit to the natural terrain. Terraces break the long slopes and slow the flow of runoff.
3. *Subsurface drains.*—When it is necessary to fill natural drainage channels, the installation of subsurface drains helps remove excess ground water.
4. *Diversions.*—Diversions, which consist of a channel and a ridge constructed across the slope, intercept and divert runoff so it will not cause damage. For diversions, stable outlets are needed to dispose of water safely.
5. *Berms.*—Berms, a type of diversion, are compacted earth ridges on a slight grade and have no channels. They may be temporary or permanent.
6. *Storm sewers.*—Storm sewers dispose of runoff from the streets and adjacent lots. In order to prevent sediment from being deposited downstream or even clogging the storm sewers, small sediment basins should be constructed adjacent to sewer inlets.
7. *Outlets.*—The construction of outlets, generally grassed waterways, helps to dispose of water safely from diversions, parking lots, streets, and other areas.
8. *Waterway stabilization structures.*—In order to prevent erosion from runoff on slopes too steep for vegetation, grade stabilization structures, special culverts, and different kinds of pipe can be used.

9. Lined channels.—Where slopes are too steep or soils too unstable for control by vegetation alone, plastic or fiberglass mats can be used as temporary lining for ditches and channels.

10. Sediment basins.—Temporary earth dams constructed across waterways can serve as sediment basins to detain runoff and trap sediment and thus prevent damage to areas downstream.

Some of the vegetative measures used to control water erosion, runoff, and soil blowing during and after construction are—

1. Mulches.—Small grain, straw, hay, and certain processed materials can be used to protect slopes and other critical areas brought to final grade at an unfavorable time for seeding. The areas can be seeded when the time is favorable without removing the mulch. Mulches need to be anchored with asphalt, straight blade disk, netting, or other methods. Hydromulching, in which seed, fertilizer, and mulch are applied as a slurry, is a fast, all-in-one operation that requires little labor.

2. Temporary cover.—Rapidly growing plants, such as annual ryegrass and small grain, can be used where cover is needed for a few months or a year or two.

3. Permanent cover.—Bermudagrass, weeping lovegrass, adapted legumes, trees, shrubs, and certain vines make good permanent ground cover. Most grasses and legumes require maintenance, such as weeding, fertilizing, and mowing.

4. Fibrous materials.—Jute netting, cotton netting, paper netting, and fiber glass matting have special uses in controlling erosion and runoff. Most of these fibrous materials are used only temporarily to hold mulches in place or prevent soil from blowing or washing during the establishment of plant seedlings.

In many areas the overall development plan does not include the control of erosion and runoff. The erosion-control measures are left up to the individual homeowner. Some of the practical erosion-control measures that protect small residential tracts are—

1. Grading.—Grade the surface of the lot to make it level or gently sloping. In areas where soils have a loamy surface layer, the topsoil can be removed and stockpiled so that it can be replaced on the graded surface.

2. Contouring.—Locate driveways, walks, fences, retaining walls and raised flower beds on the contour, or if that is not feasible, straight across the slope.

3. Diversions.—Build small diversions that will intercept runoff and keep it from flowing across erodible areas. The diversions should be protected with permanent vegetation.

4. Waterways..—Construct waterways to help prevent gullying and drain areas where water stands. Waterways need to be shaped, smoothed, and established with sod. In some places waterways can be small ditches along property lines between lots. They generally empty into ditches or paved and curbed streets.

5. Drainage.—Drain seep spots, waterlogged areas, and small ponded areas. Areas can generally be drained with ditches or tile drains. Some low areas can be filled with good topsoil.

Special care is needed in planning measures to control erosion and runoff. All should be designed to fit in well with esthetic surroundings of homesites.

Potential for urbanization

The potential of a soil is the ability of that soil to produce, yield, or support a given structure, or activity at a cost expressed in economic, social, or environmental units of value.

The soils of Lubbock County have been rated in table 16 according to their potential for urbanization. Considered are (1) dwellings without basements but with public sewer systems, (2) streets, (3) excavations in which to place utilities, and (4) uncoated steel pipes. Shopping centers and small businesses were also considered.

The soils that have the highest potential for urbanization are those on which streets and structural foundations can be placed and will not deteriorate because of adverse soil factors. In general, these soils are well drained and easy to work. They also present a landscape that is pleasing to the eye.

The factors to be considered in rating a soil potential for each element of urbanization are (1) flooding, (2) water table, (3) wetness, (4) shrink-swell potential, (5) soil strength, (6) soil texture, and (7) risk of corrosion to uncoated steel.

Soils that are flooded have a very low potential for urbanization because of the difficulty and expense involved in control of floodwater. Generally the watershed is an area much larger than that of any single land development.

Wet soils have a medium to low potential for urbanization. Most of the somewhat poorly drained soils in Lubbock County are at the bottoms of playas. These areas cannot be satisfactorily drained and should be used only for recreation.

Soils having a high shrink-swell potential or low soil strength have a medium potential for urbanization. These limitations can be partially overcome by increasing the strength of the structures.

Clayey soil material is difficult to excavate, move, or manipulate, resulting in additional cost of development and maintenance.

Soils that are highly corrosive to uncoated steel pipes generally have other limitations that lower their potential. The corrosive effect of the soil on uncoated pipes can be partially overcome by using protective coatings, by attaching anodes to the metal, or by using more resistant metals or materials, such as plastics or concrete.

Some of the limitations for building site development in table 6 are based on the rating of a single factor. For example, a soil having a high shrink-swell potential is rated as having a severe limitation. In table 16, the rating factors are cumulative, that is, a wet soil that shrinks and swells greatly and is highly corrosive to metal is rated

lower than a soil that is only wet. Further, the ratings for dwellings, streets, excavations, and uncoated steel pipes are also cumulative.

The potential of soils for urbanization is defined as follows:

Very high. Soils having very few limitations that are likely to cause problems during construction or after development. The limitations can be easily and economically corrected.

High. Soils having a few limitations that cause problems during construction or after development. The limitations can be economically overcome.

Medium. Soils having several limitations that cause problems during construction or after development. Some limitations can be easily overcome, but one or more will be difficult or expensive to overcome.

Low. Soils having several limitations that cause problems, both during construction and after development. The limitations are difficult to overcome and corrective measures are very expensive.

Very low. Soils that are flooded and have other limitations that are very difficult to overcome. These soils are best suited to uses other than urbanization.

Gardening and landscaping

Suburban homeowners who want to landscape their homes need to know the kinds of soil on their property and the kinds of flowers and ground cover, vines, shrubs, and trees that are best suited. In some areas plants may be needed for erosion control as well as for esthetic purposes.

The soils well suited to yard and garden plants have a deep root zone, a loamy texture, a balanced supply of plant nutrients, plenty of organic matter in various stages of decomposition, and adequate water supplying capacity, good drainage, and a granular structure that allows free movement of water, air, and roots. The degree of acidity or alkalinity suitable for the particular plants to be grown is also important. For example, roses and most annual flowers, most vegetables, and most grasses generally grow best in soils that are neutral, or noncalcareous. Some plants on soils high in lime, such as the Estacado soils, develop a condition called chlorosis, or yellowing of the leaves. Many flowers, shrubs, and trees, however, are well suited to the limy, or calcareous, soils in Lubbock County. Some of these flowers are shasta daisy, hollyhock, petunia, zinnia, and gladiola. Crapemyrtle, pecan, and fruitless mulberry are some of the shrubs and trees.

Other common flowers in the county are chrysanthemum, canna, marigold, pansy, snapdragon, dahlia, caladium, daylily, tulip, iris, gardenia, big leaf periwinkle, and perennial phlox.

English ivy, Virginia creeper, morningglory, honeysuckle, grape, wisteria, coral, trumpet, and jessamine are some of the vines commonly grown.

Pyracantha, bridalwreath, waxmyrtle, wax-ligustrum, holly, and oriental arborvitae are some of the shrubs.

Other trees are Austrian pine, American sycamore, hackberry, Chinese elm, eastern cottonwood, honeylocust, weeping willow, chinaberry, and Russian-olive.

Many garden vegetables are suited to the soils of Lubbock County. Examples are tomatoes, potatoes, onions, beans, peas, radishes, okra, corn, squash, cucumbers, cabbage, peppers, cantaloups, watermelons, asparagus, turnips, beets, lettuce, and broccoli. Supplemental watering, organic or chemical fertilizers, other soil amendments, mulches of artificial or organic materials, and insect control are needed for maximum production.

Most soils in Lubbock County are suitable for gardening and landscaping. The soil should be tested and the fertility needs determined for the plants to be grown. The most important amendment to the soil is organic matter, such as gin trash, peat moss, compost, rotted sawdust, or manure. At least 2 inches of organic matter should be added to the soil. For clayey soils, also add at least 2 inches of sand, perlite, calcined clay, or vermiculite. All of these materials should then be spaded or rototilled into the top 8 inches of the natural soil.

All plants, whether grown in natural soil or manmade soil, require careful maintenance, especially during the period of establishment. Good management includes fertilizing, watering, and controlling weeds and insects.

Gardening and landscaping should be included in the basic planning of urban construction. The potential of the native soil for growing plants should be considered in selecting sites for urban construction. Also important is the protection of existing trees during construction. Many potential landscape trees are killed or damaged beyond restoration because construction crews, supervisors, or property owners are careless in excavation, filling, and construction activities. For guidelines for the protection of existing trees, consult the Soil Conservation Service or Cooperative Extension Service.

Public health

Sewage disposal, sanitary landfill, and disease carrying insects all affect public health. Adequate shelter is another important factor.

Sewage disposal.—Sewerlines, septic tank systems, and sewage lagoons should be located and constructed so that the seepage or drainage from them cannot pollute the water supply. Stability of the soil is important in the location of sewerlines. If the gradeline is interrupted, the sewerage system breaks down, resulting in a public health hazard. Table 14 provides information on shrink-swell potential, corrosion potential, and volumetric shrinkage that can be of value in locating pipelines and planning for the protection of pipelines against corrosion and breakage. Water wells, streams, and lakes can become contaminated by runoff from clogged filter fields. Rapid percolation of septic tank effluent can pollute the underground water supply. Seepage from sewage lagoons built on unsuitable soil material is another cause of pollution. Table 7 rates the soils of Lubbock County as sites for septic tank absorption fields and sewage lagoons.

Sanitary landfill.—To be considered in selecting sites for sanitary landfill is the topography and drainage of the area and the characteristics of the soils, including the texture, the permeability, the reaction, and the nature of the underlying material. See table 7. Selecting sites for sanitary landfill requires onsite inspection. Excavations for sanitary landfill are generally greater than 6 feet deep, and soil maps may contain small areas of soils that have strongly contrasting properties.

Disease-carrying insects.—Mosquitoes, flies, and other disease-carrying insects breed in stagnant water. Areas subject to flooding and areas that are likely to be ponded from time to time because of nearly level topography or poor internal drainage can be identified in the soil descriptions and then identified on the soil map. Once these possible trouble spots are located, the health hazard can be controlled by spray to eliminate the insects and by installing drainage systems to remove the standing water that attracts insects.

Shelter.—Adequate housing is important in the protection of health. Houses should not be built where there is danger of flooding or of ponding of surface runoff. Floodwater is a disease carrier. It causes sewage systems to fail and attracts disease-carrying insects. Some of the soils in Lubbock County shrink and swell enough to crack foundations and walls. A health hazard results because rainwater seeps in through the cracks and insects collect in the moist spots. Studying the soil map and the soil descriptions can help planners to foresee and avoid such difficulties.

Formation, classification, and morphology of the soils

This section describes the factors of soil formation and relates them to the formation of the soils in Lubbock County. It explains the current system of soil classification and classifies the soils in the county according to that system. This part of the survey also explains the morphology of the soil series recognized in the county.

Factors of soil formation

The characteristics of a soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and vegetation are active factors of soil genesis. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body having genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for the changing of the parent material into a soil profile. It may be much or little, but some time is always required for horizon differentiation. Usually a long time is required for the development of distinct horizons.

The factors of soil genesis are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one unless conditions are specified for the other four.

Parent material

Parent material is the unconsolidated mass from which the soil develops. It has probably had more influence on the kinds of soil in the county than any other factor. The kind of soil that forms at any given place seemingly depends mainly on the kind of parent material at the surface.

Many of the soils formed in the thick, fairly uniform eolian mantle that blankets most of the county. This mantle, deposited over the southern High Plains during the Pleistocene age, is commonly referred to as cover sands (*4*, *5*). The eolian material moved in from the southwest during dry periods and periods of high winds. The eolian mantle is 10 to 40 feet thick in most places and shows good structure and soil development throughout. The material is mostly sandy clay loam, clay loam, and clay interbedded with layers of soft, pinkish-white caliche. In the southern and western parts of the county where the material is more sandy, the Amarillo and Acuff soils formed. In the northeastern part of the county where the material is less sandy and more clayey, the Pullman, Olton, and Lofton soils formed. In areas that are higher in calcium carbonate content and where caliche layers are closer to the surface, Estacado, Mansker, and Posey soils formed.

The material that occurs along the draws and in playas is more recent in age. Bippus soils formed in the loamy sediment on the valley floors along draws. Berda soils formed in a thin mantle of calcareous loamy colluvium on the lower slopes that parallel the draws. Randall soils formed at the bottom of the playas where the material is clayey. Portales, Lofton, and Zita soils formed on the benches around the playas where the material is more loamy. Drake soils formed in windblown material on the east and south sides of some playas where a ridge of loamy, highly calcareous material has recently blown from the lake basins.

Immediately below the eolian mantle on the High Plains is the Ogallala Formation. This formation, of Pliocene age, consists of calcareous, fluviatile material made up of sand and gravel. In some places the upper part is capped with caliche. This material ranges from 25 to 300 feet in thickness. Potter soils formed in this exposed caliche material.

Climate

The climate is uniform throughout the county, but its effects have been modified locally by relief and runoff. In some soils, carbonates have leached from the surface layer. In other soils, there is free lime throughout the solum. In most soils there is a lime enriched layer at a depth of 1 to 5 feet.

Climate has affected the formation of some of the soils through the action of winds. High winds, especially during duststorms, are continually moving dust laden with calcium carbonate and recharging the soil with lime.

The soils in Lubbock County formed under prairie vegetation, but in most of the soils the warm temperature restricted the accumulation of organic matter. Oxidation processes burned up most of the organic matter as it was added to the soils through the decay of plant residue and roots. The sandy Amarillo soils are low in organic matter content. The soils highest in organic matter content are Bippus, Pullman, and Lofton soils.

Plant and animal life

Plants, animals, insects, and bacteria are important in the formation of soils. Gains in organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in structure and porosity are among the changes caused by living organisms.

Vegetation, dominantly grasses, has affected soil formation in Lubbock County more than other living organisms.

Relief

Relief influences soil development through its effect on drainage and runoff. The degree of profile development depends mainly on the average amount of moisture in the soil, if other factors are equal. Nearly level soils absorb more moisture and ordinarily have better developed profiles than steeper soils. Furthermore, many of the steeper soils erode almost as fast as they form.

Relief also affects the kind and amount of vegetation on a soil. Slopes facing north and east receive less direct sunlight than those facing south and west and consequently lose less moisture through evaporation. As a result, the vegetation is denser on slopes facing north and east.

Soils that are nearly level or slightly concave are likely to have a darker color than sloping soils, because they receive more moisture, produce more vegetation, and consequently contain more organic matter, which imparts a darker color.

Time

Time is required for the formation of soils with distinct horizons. The differences in length of time that the parent material has been in place, therefore, are commonly reflected in the degree of development of the soil profile.

The soils in Lubbock county range from young to old. The young soils have very little profile development, and the older soils have well expressed soil horizons. Drake soils have been in place for a short time, and the soil horizons have only begun to form.

Soils that are intermediate in development are Berda, Bippus, and Zita soils. These soils have weak horizon development, but no silicate clay accumulation in the B horizon.

Nearly level to gently sloping soils that have been in place for long periods normally show the greatest profile development. Examples are Amarillo and Acuff soils. Time is also important in the development of these soils.

Steep, shallow soils, such as Potter, have been in the process of development as long as the well developed, nearly level soils. Geologic erosion, however, has removed the effects of soil formation in these shallow soils. Such soils have not reached an equilibrium with their environment. Here, the dominant soil-forming factor is relief, rather than time.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*9*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 17, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning burnt, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a

prefix that suggests something about the properties of the soil. An example is Paleustolls (*Pale*, meaning old, plus *ustoll*, the suborder of Mollisols that have a ustic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aridic* identifies the subgroup that is dry. An example is Aridic Paleustolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, thermic Aridic Paleustolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition. An example is the Acuff series.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (7). Unless otherwise noted, colors described are for dry soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Acuff series

The Acuff series consists of deep, loamy soils on uplands. These soils formed in calcareous loamy sediments modified by wind. Slopes are 0 to 3 percent.

Typical pedon of Acuff loam, 0 to 1 percent slopes. From the intersection of U.S. Highway 84 and Farm Road 41 in Slaton, 1.0 mile west on Farm Road 41, 1.5 miles south on county road, and 60 feet east in area of cropland:

Ap—0 to 12 inches; brown (7.5YR 4/3) loam, dark brown (7.5YR 3/3) moist; weak fine granular and subangular blocky structure; slightly hard, friable; neutral; abrupt smooth boundary.

B21t—12 to 20 inches; reddish brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate coarse prismatic structure parting to moderate fine and very fine subangular blocky; very hard, friable; common fine roots; many fine pores, common medium pores; thin patchy clay films; common worm casts; mildly alkaline; gradual wavy boundary.

B22t—20 to 28 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate coarse prismatic structure parting to moderate fine subangular blocky; very hard, friable; common fine roots; many fine pores; thin patchy clay films on ped faces; noncalcareous in upper part, calcareous in lower part; moderately alkaline; gradual wavy boundary.

B23t—28 to 38 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; hard, friable; few fine roots; common fine pores; thin patchy clay films; threads and soft bodies of calcium carbonate, about 2 percent by volume; calcareous; moderately alkaline; abrupt wavy boundary.

B24tca—38 to 58 inches; pink (5YR 8/4) sandy clay loam, pink (5YR 7/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few fine roots; thin patchy clay films; soft masses and concretions of calcium carbonate, about 40 percent by volume; calcareous; moderately alkaline; diffuse wavy boundary.

B25t—58 to 80 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; few fine roots; common fine pores; thin patchy clay films on ped surfaces; sand grains bridged and coated with clay; common films and threads of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 60 to more than 80 inches. Thickness of the mollic epipedon ranges from 11 to 18 inches. The mollic epipedon commonly includes all of the A horizon and, in some pedons, the upper part of the B2t horizon. Depth to the calcic horizon ranges from 30 to 60 inches.

The A horizon is 8 to 14 inches thick. It is dark reddish gray, reddish gray, reddish brown, brown, dark brown, or dark grayish brown. It is neutral or mildly alkaline.

The B2t horizon is sandy clay loam, clay loam, or loam. The clay content is 25 to 35 percent. This horizon is mildly alkaline or moderately alkaline. Above the calcic horizon it is reddish brown, red, yellowish red, reddish yellow, light brown, or brown. The B2tca horizon is pink, light reddish brown, light brown, or reddish yellow. The calcium carbonate content ranges from 20 to 45 percent by volume.

Amarillo series

The Amarillo series consists of deep, loamy soils on uplands. These soils formed in calcareous loamy eolian deposits. Slopes are 0 to 3 percent.

Typical pedon of Amarillo fine sandy loam, 0 to 1 percent slopes. From the intersection of U.S. Highway 87 and 82nd Street in Lubbock, 0.7 mile west on 82nd Street, and 100 feet north in area of cropland:

Ap—0 to 14 inches; reddish brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine granular structure; hard, friable; few fine roots; mildly alkaline; abrupt smooth boundary.

B21t- 14 to 24 inches; reddish brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, friable; common roots; many pores; thin discontinuous clay films on prism faces and patchy clay films on ped faces; noncalcareous; mildly alkaline; gradual wavy boundary.

B22t—24 to 33 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; few roots; common pores; nearly continuous clay films on prism faces and patchy clay films on ped faces; noncalcareous; moderately alkaline; gradual wavy boundary.

B23t- 33 to 46 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to weak fine to medium subangular blocky; hard, friable; common pores; few patchy clay films on ped faces; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B24tca- 46 to 60 inches; pink (5YR 7/4) sandy clay loam, reddish yellow (5YR 6/6) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; many soft masses and weakly cemented concretions of calcium carbonate, about 30 percent by volume; calcareous; moderately alkaline; diffuse wavy boundary.

B25tca—60 to 80 inches; pink (5YR 7/4) sandy clay loam, light reddish brown (5YR 6/4) moist; weak fine subangular blocky structure; hard, friable; few patchy clay films; many sand grains bridged with clay films; many soft masses and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 60 to more than 80 inches. Depth to the calcic horizon ranges from 30 to 60 inches.

The A horizon is 5 to 18 inches thick. It ranges from fine sandy loam to loamy fine sand. It is brown, reddish brown, or light brown. It is neutral or mildly alkaline.

The B2t horizon is mildly alkaline or moderately alkaline. Above the calcic horizon it is reddish brown, brown, yellowish red, or reddish yellow.

The B2tca horizon is pink, light reddish brown, or reddish yellow. It has soft masses and weakly cemented concretions of calcium carbonate ranging from 20 to 60 percent by volume. Below the calcic horizon it is reddish brown, pink, reddish yellow, yellowish red, or red.

Arch series

The Arch series consists of deep, loamy soils on benches around playas. These soils formed in loamy sediments that are high in lime and modified by wind. Slopes are 0 to 3 percent.

Typical pedon of Arch loam, 0 to 3 percent slopes. From the intersection of Farm Road 41 and Farm Road 1740 in Slide, 1.0 mile north on Farm Road 1730, 1.5 miles east on county road, and 500 feet north in area of cropland:

Ap—0 to 9 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak medium granular structure; soft, very friable; many fine and medium pores; calcareous; moderately alkaline; abrupt smooth boundary.

AC—9 to 17 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; many fine and very fine roots; many fine and very fine pores; few films and threads of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

C1ca—17 to 34 inches; light brownish gray (10YR 6/2) sandy clay loam, light brownish gray (10YR 6/2) moist; weak medium subangular blocky structure; slightly hard, friable; few films and threads of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

C2ca—34 to 47 inches; light gray (10YR 7/1) sandy clay loam; light gray (10YR 7/1) moist; massive; hard, friable; many medium and coarse concretions and soft powdery masses of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

C3ca—47 to 62 inches; very pale brown (10YR 7/3) fine sandy loam, very pale brown (10YR 7/3) moist; massive; soft, very friable; many masses of white calcium carbonate throughout; calcareous; moderately alkaline.

Depth to the upper boundary of the layer that contains the maximum lime accumulation ranges from 10 to 20 inches.

The A horizon is 8 to 12 inches thick. It is brown, pale brown, or light brownish gray.

The AC horizon is sandy clay loam, clay loam, or loam. It is light brownish gray, grayish brown, or pale brown. This horizon contains few to common soft masses or films and threads of calcium carbonate.

The Cca horizon is light gray, light brownish gray, very pale brown, or white. It is loam, sandy clay loam, or clay loam.

These soils are taxadjuncts to the Arch series. They typically have darker colors and a thicker Cca horizon than is defined as the range for the Arch series but are otherwise similar in morphology and behavior.

Berda series

The Berda series consists of deep, loamy soils on foot slopes along draws on uplands. These soils formed in calcareous loamy sediments mainly of slope alluvium. Slopes range from 1 to 45 percent.

Typical pedon of Berda loam, 3 to 5 percent slopes. From the intersection of Farm Road 597 and Farm Road 1264 west of Abernathy, 1.0 mile south on Farm Road 1264, 0.7 mile east on county road, and 50 feet south in range:

A1—0 to 8 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, friable; many fine roots; many fine pores; calcareous; moderately alkaline; gradual smooth boundary.

B21—8 to 20 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to moderate very fine granular and weak subangular blocky; slightly hard, friable; many fine roots; many fine pores and root channels; few fine concretions, films, and threads of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B22—20 to 28 inches; light reddish brown (5YR 6/3) loam, reddish brown (5YR 4/3) moist; weak coarse prismatic structure parting to weak fine granular and subangular blocky; slightly hard, friable; many worm casts; many root channels and pores; few concretions, films, and threads of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B23ca—28 to 40 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure; slightly hard, friable; few fine roots, few fine pores; few soft powdery masses and fine concretions of calcium carbonate; calcareous; moderately alkaline; diffuse wavy boundary.

B24ca—40 to 58 inches; brown (7.5YR 5/4) loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure; hard, friable; many fine and medium pores; many worm casts; few soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 40 to more than 60 inches. Depth to layers that contain secondary calcium carbonate ranges from 0 to 14 inches.

The A horizon is 6 to 14 inches thick. It is brown, reddish brown, or grayish brown.

The B2 and B2ca horizons are brown, light brown, grayish brown, pale brown, light brownish gray, yellowish brown, or reddish brown. They are loam, sandy clay loam, or clay loam. The clay content is 18 to 35 percent. The visible calcium carbonate content ranges from 1 to 20 percent by volume.

Bippus series

The Bippus series consists of deep, loamy soils on foot slopes and in valleys. These soils formed in loamy alluvial material. Slopes are 0 to 1 percent.

Typical pedon of Bippus clay loam, occasionally flooded. From the intersection of Farm Road 1264 and Farm Road 597 west of Abernathy, 1.0 mile south on Farm Road 1264, 0.6 mile east on county road, and 100 feet north in area of cropland:

Ap—0 to 8 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine and medium granular and subangular blocky structure; slightly hard, very friable; mildly alkaline; abrupt smooth boundary.

A1—8 to 30 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few fine roots; many fine pores; many worm casts; few films and threads of calcium carbonate; mildly alkaline; gradual smooth boundary.

B21—30 to 55 inches; brown (7.5YR 5/2) clay loam, dark brown (7.5YR 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable; few worm casts; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22—55 to 72 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable; few films and threads of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum is more than 50 inches. Thickness of the mollic epipedon is 20 to 40 inches.

The A horizon is 12 to 40 inches thick. It is dark brown, dark grayish brown, or very dark grayish brown. It is clay loam or fine sandy loam. It is mildly alkaline or moderately alkaline.

The B2 horizon is clay loam or sandy clay loam. The clay content is 20 to 35 percent. The B21 horizon is brown, grayish brown, or dark grayish brown. The B22 horizon is reddish brown, brown, or yellowish red.

Bippus fine sandy loam is a taxadjunct to the series. This soil has 20 to 30 inches of nonmollic fine sandy loam material of more recent deposition on the surface but is similar in use and management.

Drake series

The Drake series consists of deep, loamy soils on uplands. These soils formed in calcareous loamy sediments modified by wind.

Typical pedon of Drake clay loam, 1 to 3 percent slopes. From the intersection of Farm Road 789 and 1527 near Estacado, 4.5 miles north on Farm Road 789, 2 miles west and 0.5 mile south on county road, and 300 feet west in area of cropland:

Ap—0 to 10 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable; calcareous; moderately alkaline; abrupt smooth boundary.

C1—10 to 28 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few soft masses of calcium carbonate in lower part; calcareous; moderately alkaline; gradual smooth boundary.

C2—28 to 60 inches; light gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable; few soft masses of calcium carbonate in upper part; calcareous; moderately alkaline.

These soils are more than 60 inches thick.

The A horizon is brown, grayish brown, or light brownish gray.

The C horizon is clay loam or sandy clay loam. It is brown, grayish brown, light brownish gray, or light gray. The calcium carbonate content ranges from 5 to 30 percent by volume.

Estacado series

The Estacado series consists of deep, loamy soils on uplands. These soils formed in calcareous loamy eolian sediments. Slopes are 0 to 3 percent.

Typical pedon of Estacado clay loam, 0 to 1 percent slopes. From the intersection of Farm Road 1730 and Farm Road 1585 south of Lubbock, 2.0 miles north on Farm Road 1730, 0.4 mile east on county road, and 50 feet north in area of cropland:

Ap—0 to 10 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak medium granular structure; hard, friable; common fine pores; calcareous; moderately alkaline; abrupt smooth boundary.

A1—10 to 16 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; many fine pores; common worm casts; calcareous; moderately alkaline; clear smooth boundary.

B21tca—16 to 26 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; few fine roots; many fine pores; patchy clay films; many fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual irregular boundary.

B22tca—26 to 40 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine roots; common fine pores; few patchy clay films; many slightly cemented concretions and few soft masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23tca—40 to 66 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; few coarse pores; few coarse root channels; many fine masses and concretions of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum is more than 60 inches. Depth to the calcic horizon ranges from 10 to 30 inches.

The A horizon is 7 to 18 inches thick. It is brown, dark brown, very dark brown, grayish brown, or dark grayish brown.

The B2ca horizon is clay loam or sandy clay loam. The clay content is 18 to 28 percent. The calcium carbonate content is 10 to 50 percent by volume of this horizon. This horizon is reddish brown, brown, light brown, light reddish brown, yellowish red, strong brown, or reddish yellow.

Friona series

The Friona series consists of moderately deep, loamy soils on uplands. These soils formed in calcareous loamy eolian sediments. Slopes are 0 to 1 percent.

Typical pedon of Friona loam, 0 to 1 percent slopes. From the intersection of Farm Road 1729 and Farm Road 835 east of Lubbock, 100 feet south on Farm Road 835, and 100 feet east in area of cropland:

Ap—0 to 8 inches; reddish brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) moist; weak fine granular structure; slightly hard, very friable; many fine roots; mildly alkaline; abrupt smooth boundary.

B21t—8 to 15 inches; reddish brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, friable; many pores; many worm casts; thin patchy clay films, mostly on prism

faces; few films and threads of calcium carbonate in lower part; calcareous; moderately alkaline; clear smooth boundary.

B22t—15 to 26 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; many fine pores; common worm casts; thin patchy clay films, mostly on ped surfaces; few films, threads, and masses of calcium carbonate; calcareous; moderately alkaline; abrupt smooth boundary.

B23cam—26 to 32 inches; pinkish white (5YR 8/2) caliche; indurated in the upper part and strongly cemented in the lower part; the upper surface is laminar and smooth; the lower part has pendants of calcium carbonate as much as 1 centimeter long; gradual wavy boundary.

B24ca—32 to 60 inches; pink (7.5YR 8/4) sandy clay loam, pink (7.5YR 7/4) moist; weak medium subangular blocky structure; slightly hard, friable; about 50 percent calcium carbonate in soft powdery forms; calcareous; moderately alkaline.

Depth to the Bcam horizon ranges from 20 to 40 inches. Thickness of the mollic epipedon ranges from 8 to 16 inches. Depth to secondary carbonates ranges from 15 to 25 inches.

The A horizon is brown or reddish brown. It is neutral to moderately alkaline.

The B2t horizon above the petrocalcic horizon is brown, reddish brown, or yellowish red. It is clay loam or sandy clay loam. The B2cam horizon is 2 to 8 inches thick and is indurated to strongly cemented.

Kimbrough series

The Kimbrough series consists of shallow, loamy soils on uplands. These soils formed in loamy calcareous eolian deposits. Slopes are 0 to 3 percent.

Typical pedon of Kimbrough loam, 0 to 3 percent slopes. From the intersection of Farm Road 1729 and Farm Road 835 east of Lubbock, 0.5 mile north on Farm Road 1729, 1.0 mile east on county road, 220 feet north on second county road, and 980 feet east in area of cropland:

Ap—0 to 11 inches; brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; slightly hard, very friable; surface is covered with hard caliche fragments, about 20 percent by volume; calcareous; mildly alkaline; abrupt smooth boundary.

Ccam—11 to 14 inches; pinkish white (7.5YR 8/2) indurated platy caliche that contains a few fractures with surface soil material and roots in the fractures; the upper surface is smooth and laminar and becomes strongly cemented in the lower part; gradual smooth boundary.

C2ca—14 to 34 inches; pinkish white (5YR 8/2) sandy clay loam, pinkish gray (5YR 7/2) moist; about 70 percent weakly cemented caliche fragments that have a hardness of less than 3 Moh's scale and that range from 1 inch to 3 inches on the long axis; about 30 percent soft loamy material and soft powdery caliche.

Depth to the petrocalcic horizon ranges from 6 to 18 inches. The content of caliche fragments in the surface layer ranges from 10 to 30 percent by volume.

The A horizon is brown or dark grayish brown. It is mildly alkaline or moderately alkaline.

The Ccam horizon is indurated and fractured and is continuous horizontally for several meters. Thickess of the hard laminar cap ranges from 2 to 6 inches.

Lofton series

The Lofton series consists of deep, loamy soils on benches around playas or in slight depressions on uplands. These soils formed in calcareous loamy eolian or lacustrine sediments. Slopes are 0 to 1 percent.

Typical pedon of Lofton clay loam, 0 to 1 percent slopes. From the intersection of Farm Road 789 and Farm Road 1527 near Estacado, 1.0 mile east on Farm Road 1527, 1.1 miles north on county road, and 300 feet west in area of cropland:

Ap—0 to 10 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak fine granular and subangular blocky structure; hard, friable; mildly alkaline; abrupt smooth boundary.

B21t—10 to 26 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; very hard, firm; continuous clay films on ped surfaces; mildly alkaline; clear wavy boundary.

B22t—26 to 40 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong medium blocky structure; very hard, firm; continuous clay films on ped surfaces; few films and threads of visible calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B23t—40 to 50 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak subangular blocky structure; hard, friable; common films, threads, and soft masses of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

B31ca—50 to 64 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; weak medium blocky structure; hard, friable; about 35 percent visible soft powdery calcium carbonate; calcareous; moderately alkaline; diffuse wavy boundary.

B32ca—64 to 72 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; weak medium blocky structure; hard, friable; about 10 to 15 percent visible calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 45 to more than 60 inches. The mollic epipedon is 20 to 40 inches thick. The clay content of the argillic horizon is 40 to 50 percent. When the soil is dry, vertical cracks extend to a depth of 24 to 36 inches. Depth to the calcic horizon ranges from 40 to 60 inches.

The A horizon is 6 to 10 inches thick. It is dark grayish brown, dark gray, or very dark gray. It is neutral to moderately alkaline.

The B2t horizon is dark gray, very dark gray, or dark grayish brown. Thickness of the calcic horizon ranges from 12 to 30 inches.

Mansker series

The Mansker series consists of deep, loamy soils on uplands. These soils formed in calcareous loamy eolian material. Slopes are 1 to 5 percent.

Typical pedon of Mansker clay loam, 1 to 3 percent slopes. From the intersection of Loop 289 and Farm Road 40 in east Lubbock, 1.2 miles east on Farm Road 40, 0.7 mile south on county road, and 75 feet east in area of cropland:

Ap—0 to 8 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak medium granular structure; slightly hard, friable; many fine roots; many fine pores; few worm casts; common strongly cemented and few weakly cemented concretions of calcium carbonate as much as 1 centimeter in diameter; calcareous; moderately alkaline; abrupt smooth boundary.

B21ca—8 to 15 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few roots; few worm casts; weakly cemented concretions, powdery masses, and a few strongly cemented concretions of calcium carbonate, about 35 percent by volume; calcareous; moderately alkaline; diffuse wavy boundary.

B22ca—15 to 32 inches; pink (5YR 8/4) clay loam, pink (5YR 7/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few roots; few worm casts; soft masses and slightly cemented concretions of calcium carbonate, about 60 percent by volume; calcareous; moderately alkaline; diffuse wavy boundary.

B23tca—32 to 60 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few fine roots in upper part; patchy clay films on ped surfaces; about 10 percent calcium carbonate, mostly in coatings and soft powdery masses on surfaces of peds, and few concretions; calcareous; moderately alkaline.

Thickness of the solum is more than 60 inches. The control section is clay loam or sandy clay loam. The clay content is 25 to 35 percent. A calcic horizon is above the Bt horizon, and the calcium carbonate content ranges from 40 to 60 percent. The mollic epipedon ranges from 8 to 14 inches in thickness.

The A horizon is brown, grayish brown, or dark grayish brown.

The B2ca horizon above the B2tca horizon is light reddish brown, pinkish gray, pink, light brown, or pale brown. The B2tca horizon is reddish yellow, yellowish red, or red. The B horizon is clay loam or sandy clay loam.

Midessa series

The Midessa series consists of deep, loamy soils on uplands. These soils formed in calcareous loamy eolian material. Slopes are 1 to 3 percent.

Typical pedon of Midessa fine sandy loam, 1 to 3 percent slopes. From the intersection of Farm Road 1729 and Farm Road 2528 northeast of Shallowater, 2.0 miles north on Farm Road 2528, 1.0 mile west on county road to Caldwell Community, 0.7 mile north on county road, and 75 feet west in area of cropland:

Ap—0 to 7 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky and granular structure; slightly hard, friable; many roots; few fine concretions of calcium carbonate; calcareous; moderately alkaline; abrupt smooth boundary.

B21—7 to 23 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; weak fine subangular blocky and granular structure; slightly hard, friable; few fine roots; few fine pores; few films, threads, and fine concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

B22ca—23 to 44 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; weak fine subangular blocky structure; slightly hard, friable; soft masses and concretions of calcium carbonate, 30 percent by volume; calcareous; moderately alkaline; gradual wavy boundary.

C—44 to 66 inches; pinkish white (7.5YR 8/2) sandy clay loam, pinkish gray (7.5YR 7/2) moist; massive; slightly hard, friable; visible calcium carbonate, about 5 percent by volume; calcareous; moderately alkaline.

Thickness of the solum ranges from 40 to 60 inches. Depth to the calcic horizon ranges from 20 to 40 inches.

The A horizon is 7 to 14 inches thick. It is brown, pale brown, or grayish brown.

The B21 horizon is 4 to 28 inches thick. Color is light brown, pale brown, or brown. Texture is sandy clay loam or clay loam. The clay content is 20 to 35 percent. The B22ca horizon is pinkish white, pinkish gray, pink, light brown, light gray, light brownish gray, very pale brown, or pale brown. The calcium carbonate content ranges from 15 to 40 percent by volume. This horizon is clay loam or sandy clay loam.

The C horizon is loam, sandy clay loam, or clay loam. It is pink, pinkish white, light reddish brown, or light brown.

Mobeetie series

The Mobeetie series consists of deep, loamy soils on alluvial fans and foot slopes. These soils formed in calcareous loamy slope alluvium. Slopes are 1 to 8 percent.

Typical pedon of Mobeetie fine sandy loam, 3 to 5 percent slopes. From the intersection of Farm Road 40 and Slaton Road in Acuff, 6.7 miles south on Slaton Road and 100 feet east in range:

A1—0 to 10 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, very friable; common fine and very fine pores; common worm casts; few fine caliche fragments and fine and very fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B2—10 to 26 inches; pale brown (10YR 6/3) fine sandy loam, brown (7.5YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; many medium fine and very fine pores; many worm casts; few films and threads of calcium carbonate on ped faces; few strongly cemented calcium carbonate concretions and caliche fragments as much as 1 centimeter in diameter; calcareous; moderately alkaline; diffuse wavy boundary.

B3ca—26 to 42 inches; pink (7.5YR 7/3) fine sandy loam, light brown (7.5YR 6/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky and granular; slightly hard, friable; many medium, fine, and very fine pores; many worm casts; many films and threads of calcium carbonate on ped surfaces; weakly to strongly cemented concretions of calcium carbonate, less than 1 percent by volume; calcareous; moderately alkaline; diffuse boundary.

C—42 to 72 inches; pink (7.5YR 7/4) fine sandy loam, light brown (7.5YR 6/4) moist; massive; slightly hard, friable; many medium to very fine pores; few worm casts; few films and threads of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 24 to 60 inches. Depth to secondary calcium carbonate ranges from 0 to 10 inches. The clay content of the control section is 12 to 18 percent.

The A horizon is pinkish gray, brown, light reddish brown, pale brown, grayish brown, or reddish brown.

The B horizon above the calcic horizon is light reddish brown, reddish brown, brown, light brown, grayish brown, pale brown, light yellowish brown, yellowish brown, or light brownish gray. The B3ca and C horizons are pink, light reddish brown, light brown, light yellowish brown, very pale brown, or reddish yellow. The calcium carbonate content ranges from less than 1 percent to about 12 percent. Caliche fragments and concretions as much as 2 or 3 inches in diameter are in most pedons. The B and C horizons are fine sandy loam or loam.

Olton series

The Olton series consists of deep, loamy soils on uplands. These soils formed in calcareous loamy eolian sediments. Slopes are 0 to 3 percent.

Typical pedon of Olton clay loam, 0 to 1 percent slopes. From the intersection of U.S. Highway 87 and Farm Road 1294, 0.6 mile east on Farm Road 1294 and 50 feet north in area of cropland:

Ap—0 to 10 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak moderate granular and subangular blocky structure; slightly hard, friable; mildly alkaline; abrupt smooth boundary.

B21t—10 to 18 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine and medium blocky and subangular blocky structure; very hard, firm; few pores; clay films on ped surfaces; mildly alkaline; gradual wavy boundary.

B22t—18 to 30 inches; reddish brown (5YR 5/3) clay loam, reddish brown (5YR 4/3) moist; moderate fine and medium blocky and subangular blocky structure; very hard, firm; few pores; clay films on ped surfaces; few films and threads of calcium carbonate in lower part; calcareous; moderately alkaline; diffuse wavy boundary.

B23tca—30 to 42 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; weak medium prismatic structure parting to

moderate medium subangular blocky; very hard, firm; clay films on ped surfaces; few films and threads of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

B24tca—42 to 60 inches; pink (5YR 7/4) clay loam, light reddish brown (5YR 6/4) moist; few medium distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; hard, friable; few clay films on ped surfaces not covered with calcium carbonate; soft powdery calcium carbonate, about 40 percent by volume; calcareous; moderately alkaline; diffuse wavy boundary.

B25tca—60 to 80 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; few medium distinct red (2.5YR 4/6) mottles; weak medium subangular blocky structure; hard, friable; clay films on ped surfaces not covered with calcium carbonate; soft powdery masses of calcium carbonate, about 25 percent by volume; calcareous; moderately alkaline.

Thickness of the solum ranges from 60 to more than 120 inches. The mollic epipedon is 11 to 20 inches thick. The average clay content of the upper 20 inches of the Bt horizon ranges from 35 to 45 percent. Depth to secondary calcium carbonate ranges from 16 to 28 inches. Depth to the calcic horizon ranges from 30 to 60 inches.

The A horizon is dark brown, brown, or reddish brown.

The B2t horizon above the calcic horizon is grayish brown, brown, reddish brown, dark reddish brown, strong brown, or yellowish red. It ranges from clay loam to clay. The calcic horizon is pink or reddish yellow. The calcium carbonate content ranges from 20 to 45 percent. This horizon is sandy clay loam or clay loam.

Portales series

The Portales series consists of deep, loamy soils on uplands. These soils formed in calcareous loamy eolian or alluvial sediments. Slopes are 0 to 1 percent.

Typical pedon of Portales loam, 0 to 1 percent slopes. From the common intersection of Farm Road 789, Farm Road 1527, and a county road near Estacado, 0.9 mile west on county road and 100 feet north in area of cropland:

Ap—0 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; calcareous; moderately alkaline; abrupt smooth boundary.

B21—14 to 22 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, firm; few pores; few worm casts; calcareous; moderately alkaline; gradual wavy boundary.

B22—22 to 36 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, firm; few pores; few worm casts; calcareous; moderately alkaline; gradual wavy boundary.

C1ca—36 to 60 inches; white (10YR 8/2) clay loam, light gray (10YR 7/2) moist; massive; slightly hard, friable; soft powdery masses of calcium carbonate, about 40 percent by volume; calcareous; moderately alkaline; diffuse wavy boundary.

C2—60 to 80 inches; light gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable; many fine faint yellow mottles; soft masses of calcium carbonate, about 10 percent by volume; calcareous; moderately alkaline.

Thickness of the mollic epipedon ranges from 11 to 20 inches. The control section ranges from clay loam to sandy clay loam. The average clay content ranges from 28 to 35 percent. Depth to the calcic horizon ranges from 20 to 40 inches.

The A horizon is 10 to 18 inches thick. It is dark grayish brown, grayish brown, or brown.

The B2 horizon is 8 to 24 inches thick. It is gray, grayish brown, light brownish gray, or pale brown. It is clay loam or sandy clay loam.

The C1ca horizon is 15 to 30 inches thick. It is light gray, white, or very pale brown. It is clay loam or sandy clay loam. The content of secondary calcium carbonate ranges from 20 to 40 percent by volume. The C2 horizon is light gray. It has a few yellow mottles in some pedons. It ranges from clay loam to sandy clay loam.

Posey series

The Posey series consists of deep, loamy soils on uplands. These soils formed in calcareous loamy eolian sediments. Slopes are 0 to 8 percent.

Typical pedon of Posey fine sandy loam, 3 to 5 percent slopes. From the intersection of Farm Road 1729 and Farm Road 1264 west of New Deal, 2.0 miles south on Farm Road 1264, 300 feet east on county road, and 50 feet north in area of cropland:

Ap—0 to 10 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine and medium granular structure; soft, friable; few roots; few weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; abrupt smooth boundary.

B21tca—10 to 18 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; few coarse roots; many pores; many worm casts; few masses, films, and threads of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B22tca—18 to 39 inches; light reddish brown (5YR 6/4) sandy clay loam, reddish brown (5YR 5/4) moist; weak coarse prismatic structure parting to moderate fine subangular blocky; very hard, firm; few roots; many fine pores; soft masses and concretions of calcium carbonate, about 40 percent by volume; calcareous; moderately alkaline; gradual wavy boundary.

B23t—39 to 80 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; few roots; many pores; sand grains coated and bridged with clay; about 10 percent of soil mass is weakly cemented calcium carbonate mainly on ped faces; calcareous; moderately alkaline.

Thickness of the solum is more than 60 inches. A calcic horizon begins near the top of the Bt horizon. The clay content of the control section ranges from 25 to 35 percent.

The A horizon is light reddish brown, light brown, reddish brown, brown, or grayish brown.

The B2tca horizon is light reddish brown, light brown, pink, reddish brown, brown, reddish yellow, or yellowish red. It ranges from sandy clay loam to clay loam. The calcium carbonate content ranges from 5 to 30 percent by volume and is concentrated on vertical faces of prisms. The Bt horizon below the calcic horizon is reddish yellow or yellowish red. It is sandy clay loam or clay loam. The calcium carbonate content ranges from 10 to 20 percent by volume.

Potter series

The Potter series consists of very shallow to shallow, loamy soils on uplands. These soils formed in calcareous loamy caliche beds. Slopes range from 1 to 45 percent.

Typical pedon of Potter loam, 2 to 12 percent slopes. From the intersection of Boston Avenue and Marshall Street in northwest Lubbock, 100 feet north on Boston Avenue and 40 feet east in native grass:

A11—0 to 5 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable; many fine roots; few fine pores; many medium concretions of calcium carbonate; few hard caliche fragments as much as 5 centimeters in diameter on the surface; calcareous; moderately alkaline; abrupt smooth boundary.

A12—5 to 12 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable; common fine roots; few fine pores; common fine concretions of calcium carbonate; few hard caliche fragments; few worm casts; few fine insect burrows; calcareous; moderately alkaline; abrupt smooth boundary.

C1ca—12 to 18 inches; white (10YR 8/2) slightly platy caliche that has hardness of less than 3 on Moh's scale in the upper part but can be cut with a spade; plates are fractured, and undersides have pendants of calcium carbonate from 1/4 to 1/2 inch long; calcareous; moderately alkaline; clear smooth boundary.

C2ca—18 to 30 inches; white (10YR 8/2) loamy material; about 60 percent by volume, caliche fragments that have hardness of slightly less than 3 on Moh's scale and range from 1 inch to 4 inches on the long axis.

Thickness of the solum ranges from 4 to 12 inches.

The A horizon is grayish brown, pinkish gray, pale brown, or brown. It is loam or clay loam.

The Cca horizon is white caliche that is slightly platy in the upper part.

Pullman series

The Pullman series consists of deep, loamy soils on uplands. These soils formed in clayey eolian material. Slopes are 0 to 1 percent.

Typical pedon of Pullman clay loam, 0 to 1 percent slopes. From the intersection of Farm Road 789 and Farm Road 1527 near Estacado, 3.5 miles north on Farm Road 789, 1.2 miles east on county road, and 100 feet south in area of cropland:

Ap—0 to 12 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak fine granular and subangular blocky structure; hard, friable; mildly alkaline; abrupt smooth boundary.

B21t—12 to 22 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate fine angular blocky structure; very hard, firm; clay films on ped surfaces; moderately alkaline; clear wavy boundary.

B22t—22 to 34 inches; brown (7.5YR 5/3) clay, dark brown (7.5YR 3/3) moist; moderate fine angular blocky structure; very hard, firm; clay films on ped surfaces; few films and threads of calcium carbonate; calcareous; moderately alkaline; diffuse wavy boundary.

B23t—34 to 46 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate medium blocky structure; very hard, firm; clay films on ped surfaces; few films, threads, and soft masses of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

B24tca—46 to 66 inches; pink (5YR 7/4) clay, light reddish brown (5YR 6/4) moist; moderate medium blocky and subangular blocky structure; hard, friable; clay films on faces of peds; about 30 percent by volume soft powdery calcium carbonate; calcareous; moderately alkaline; diffuse wavy boundary.

B25tca—66 to 80 inches; reddish yellow (5YR 6/6) clay, yellowish red (5YR 4/6) moist; moderate medium blocky and subangular blocky structure; hard, friable; clay films on faces of peds; about 15 percent by volume soft powdery calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 60 to more than 80 inches. Secondary calcium carbonate occurs at a depth of 15 to 30 inches. Depth to the calcic horizon ranges from 30 to 60 inches. Cracks extend to a depth of 24 to 36 inches when the soil is dry. The mollic epipedon extends to a depth of 20 to 36 inches. The clay content of the upper 20 inches of the Bt horizon ranges from 40 to 50 percent.

The A horizon is 7 to 12 inches thick. It is brown, grayish brown, or dark grayish brown.

The Bt horizon above the calcic horizon ranges from clay loam to clay. It is brown, dark brown, or reddish brown.

The Btca horizon is clay or clay loam. It is pink, reddish brown, reddish yellow, or yellowish red. The calcium carbonate content ranges from 30 to 50 percent.

Randall series

The Randall series consists of deep, clayey soils in the bottoms of playas or in enclosed depressions. These soils formed in clayey sediments several feet thick underlain by caliche in some places. They crack when dry and have gilgai microrelief. Slopes are 0 to 1 percent.

Typical pedon of Randall clay. From the intersection of Farm Road 1264 and Farm Road 597 west of Abernathy, 1.0 mile south on Farm Road 1264, 1.0 mile west, 50 feet south on county road, and 100 feet west in native grass at the center of a microknoll:

A11—0 to 7 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine and very fine granular and subangular blocky structure; hard, firm; many roots; moderately alkaline; clear wavy boundary.

A12—7 to 20 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine and medium angular blocky structure; extremely hard, very firm; many roots; parallelepipeds 1 inch to 3 inches long with the long axis tilted 10 to 30 degrees from horizontal; many short intersecting slickensides; many shiny ped faces; moderately alkaline; gradual smooth boundary.

AC1—20 to 38 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate to strong fine and medium angular blocky structure; extremely hard, very firm; parallelepipeds 1 inch to 3 inches long with the long axis tilted 10 to 30 degrees from horizontal; many shiny ped faces; many intersecting slickensides; few black rounded concretions as much as 5 millimeters in diameter; few fine concretions of calcium carbonate; moderately alkaline; gradual smooth boundary.

AC2—38 to 62 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; weak fine and medium angular blocky structure; extremely hard, very firm; many parallelepipeds; many short intersecting slickensides; few vertical lenses, a few millimeters wide of dark gray material in old cracks; few black concretions; few concretions of calcium carbonate; calcareous; moderately alkaline.

Depth of the soil is more than 72 inches. When this soil is dry, it has cracks from 0.4 inch to 1.6 inches wide and more than 20 inches deep. Virgin areas have gilgai microrelief; knolls are 3 to 8 inches higher than depressions. Intersecting slickensides and parallelepipeds begin at a depth of 6 to 20 inches. The clay content of the control section ranges from 40 to 60 percent.

The A horizon is 12 to 50 inches thick. It is dark gray or very dark gray.

The AC horizon is dark gray, dark grayish brown, grayish brown, or gray. Secondary calcium carbonate ranges from a few weakly or strongly cemented concretions to about 10 percent soft powdery masses.

Randall Variant

The Randall Variant consists of deep, loamy soils in shallow playas. These soils formed in clayey sediments with fine sandy loam deposited by wind covering the clay. Slopes are 0 to 1 percent.

Typical pedon of Randall Variant fine sandy loam. From the intersection of Loop 289 and University Avenue in Lubbock, 4.5 miles south on University Avenue, 0.5 mile east on county road, and 50 feet south in area of cropland:

Ap—0 to 14 inches; reddish brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine granular structure; soft, very friable; few fine roots; noncalcareous; moderately alkaline; abrupt smooth boundary.

A1—14 to 20 inches; brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; stratified with reddish brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak very fine subangular blocky structure; hard, friable, slightly sticky; few fine roots; noncalcareous; moderately alkaline; abrupt smooth boundary.

IIA11—20 to 37 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak fine subangular blocky and blocky structure; hard, firm, very sticky; few fine roots; cracks and old wormholes filled with gray loamy material; noncalcareous; moderately alkaline; clear smooth boundary.

IIA12—37 to 50 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; many fine intersecting slickensides; many shiny pressure faces; noncalcareous; moderately alkaline; gradual smooth boundary.

IIAC—50 to 80 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; many parallelepipeds; many fine intersecting slickensides; few soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

Depth of the soil is more than 80 inches. Reaction ranges from neutral through moderately alkaline.

The A horizon is dark reddish gray, reddish gray, reddish brown, light reddish brown, yellowish red, reddish yellow, dark brown, brown, or strong brown. It is stratified fine sandy loam and loam.

The IIA horizon is very dark gray or dark gray.

The IIAC horizon is dark gray or gray. Concretions of calcium carbonate are few to common.

Zita series

The Zita series consists of deep, loamy soils on uplands. These soils formed in loamy eolian or wind-altered lacustrine deposits. Slopes are 0 to 1 percent.

Typical pedon of Zita loam, 0 to 1 percent slopes. From the intersection of U.S. Highway 87 and Farm Road 1294 north of Lubbock, 1.1 miles east on Farm Road 1294 and 1,320 feet north in area of cropland:

Ap—0 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak granular and subangular blocky structure; slightly hard, friable; moderately alkaline; abrupt smooth boundary.

A1—12 to 19 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; hard, friable; few pores; few worm casts; moderately alkaline; clear wavy boundary.

B21—19 to 28 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable; few pores; few worm casts; few visible films and threads of calcium carbonate; calcareous; moderately alkaline; diffuse wavy boundary.

B22—28 to 36 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; common films and threads and few soft masses of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

C1ca—36 to 54 inches; white (10YR 8/2) clay loam, light gray (10YR 7/2) moist; massive; slightly hard, friable; about 60 percent visible soft calcium carbonate; calcareous; moderately alkaline; diffuse wavy boundary.

C2—54 to 66 inches; white (10YR 8/2) clay loam, light gray (10YR 7/2) moist; massive; slightly hard, friable; about 10 to 15 percent visible soft masses of calcium carbonate; calcareous; moderately alkaline.

Thickness of the solum ranges from 30 to 60 inches. Depth to secondary calcium carbonate is 10 to 24 inches. The mollic epipedon is 10 to 20 inches thick. The average clay content of the control section ranges from 25 to 35 percent.

The A horizon is 10 to 20 inches thick. Texture is loam or fine sandy loam. Color is brown, dark brown, grayish brown, or dark grayish brown.

The B horizon is 12 to 24 inches thick. It is clay loam or sandy clay loam. It is brown, light brownish gray, light brown, or grayish brown.

The C horizon ranges from white and pinkish gray to light gray and very pale brown. It is silty clay loam or clay loam. The content of visible calcium carbonate ranges from 20 to 70 percent.

Zita fine sandy loam has about 10 inches of nonmollic fine sandy loam deposited on the surface. It is considered a taxadjunct to the series. This difference, however, does not affect use and management.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warmitemperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Emergency tillage. An emergency conservation practice to temporarily protect cultivated land from soil blowing during critical wind erosion periods. It consists of roughening the soil surface by any mechanical method when other protective methods have failed.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Favorable. Favorable soil features for the specified use.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May,* for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant not a grass or a sedge.

Gilgai. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants are those that follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Outwash plain. A land form of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characterisitc that affects management. These differencees are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poorly graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor.* The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt*, *silt loam*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Illustrations

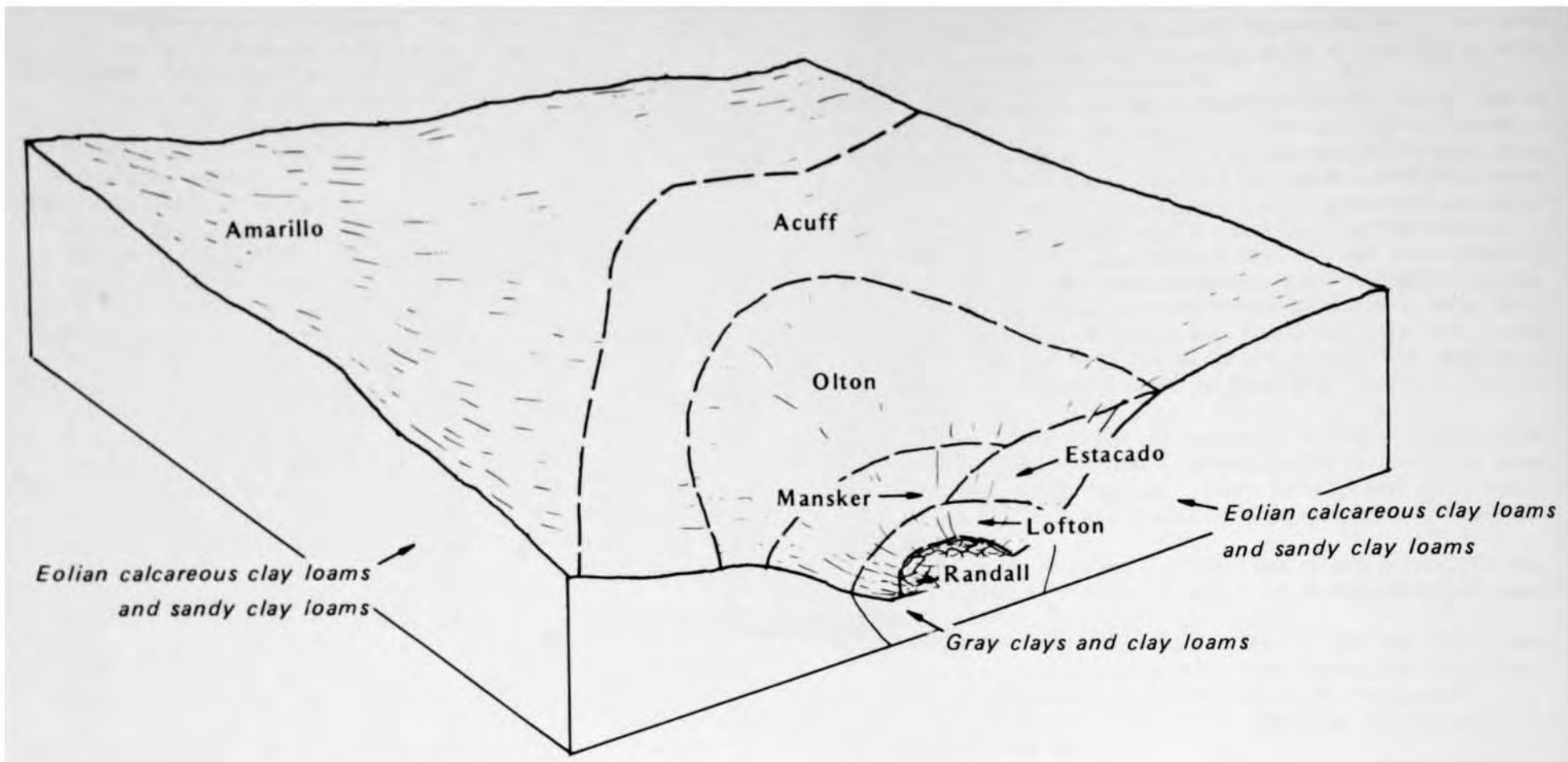

Figure 1.—Typical pattern of soils in Amarillo-Acuff unit.

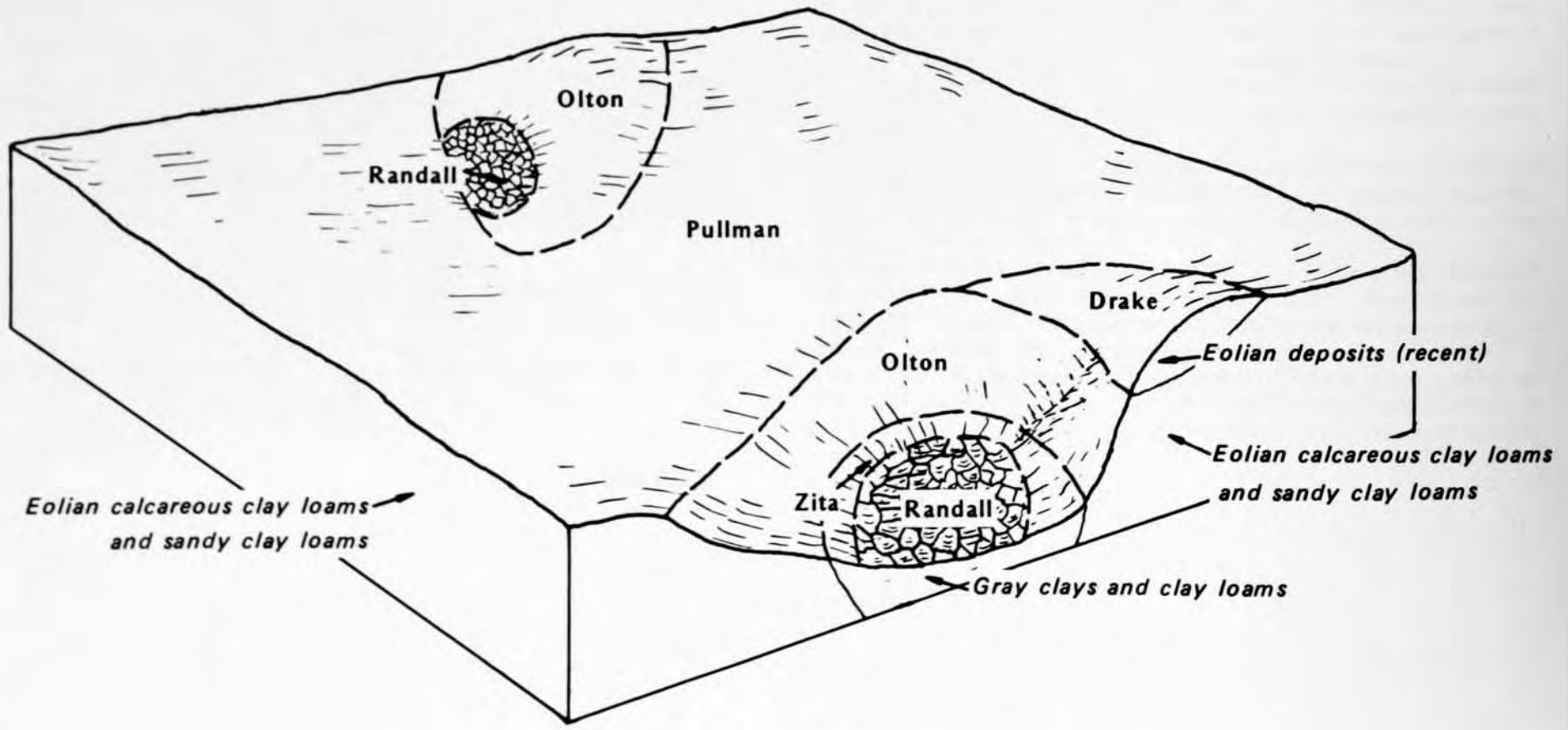

Figure 2.—Typical pattern of soils in Pullman-Olton unit.

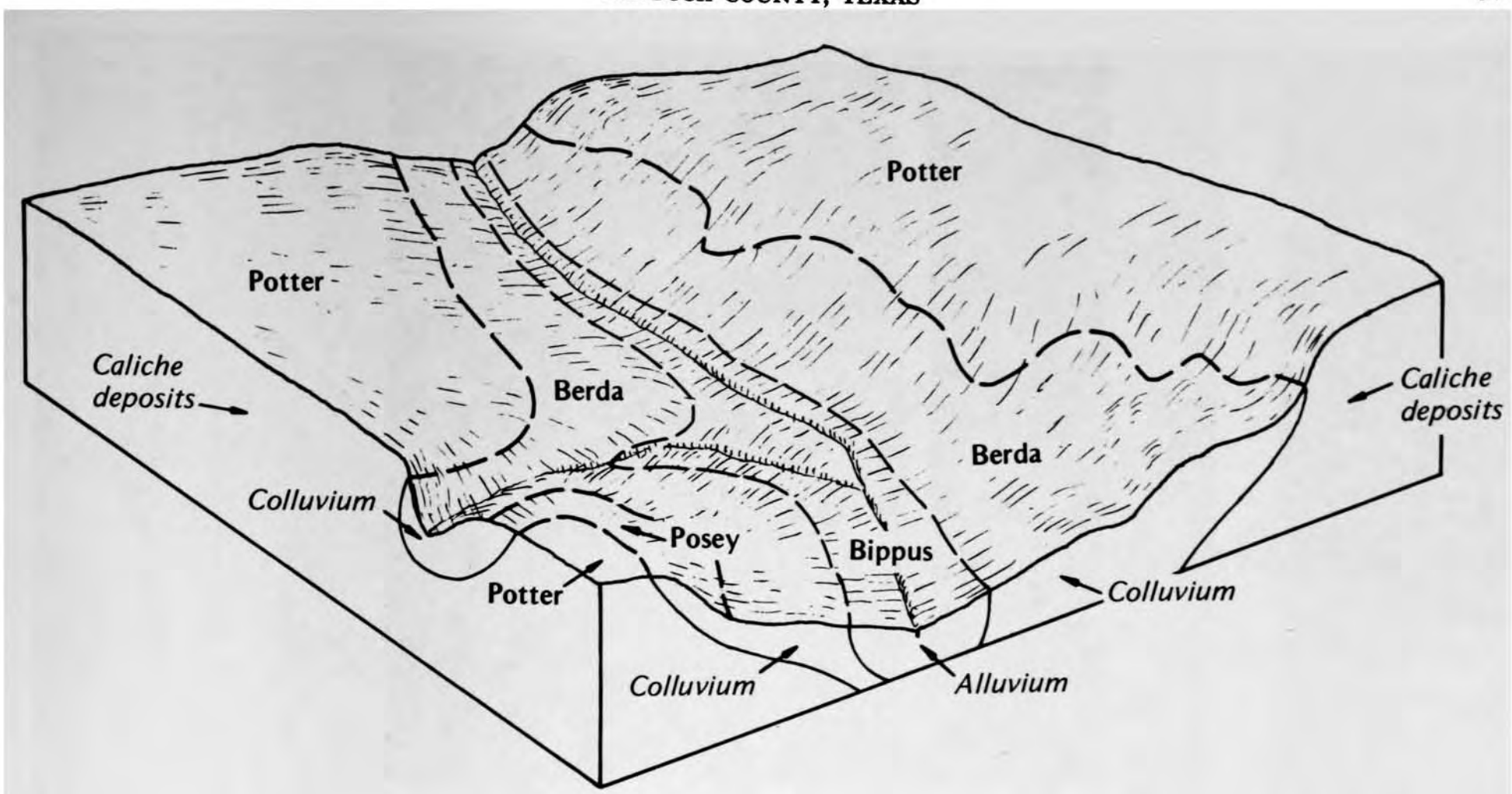

Figure 3.—Typical pattern of soils in Potter-Berda-Bippus unit.

Figure 4.—Cotton harvest on Acuff loam, 0 to 1 percent slopes.

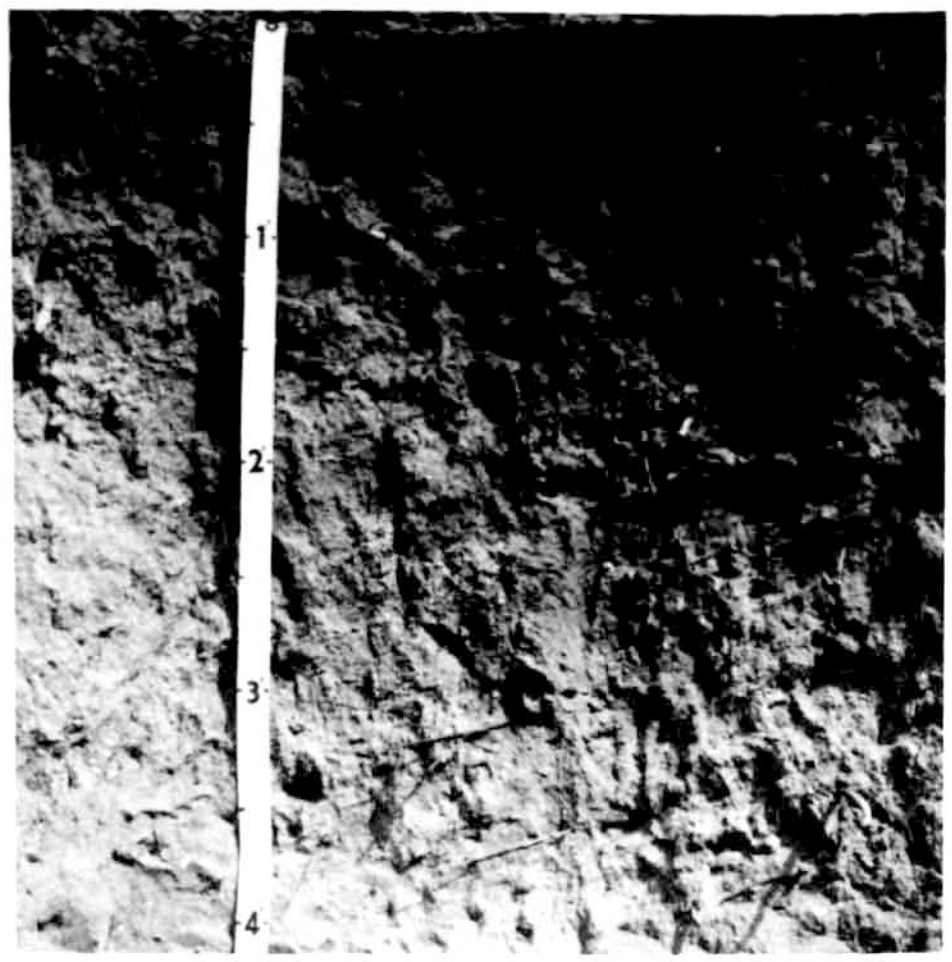

Figure 5.—Profile of Berda loam.

Figure 6.—Landscape of Berda-Potter association, hilly.

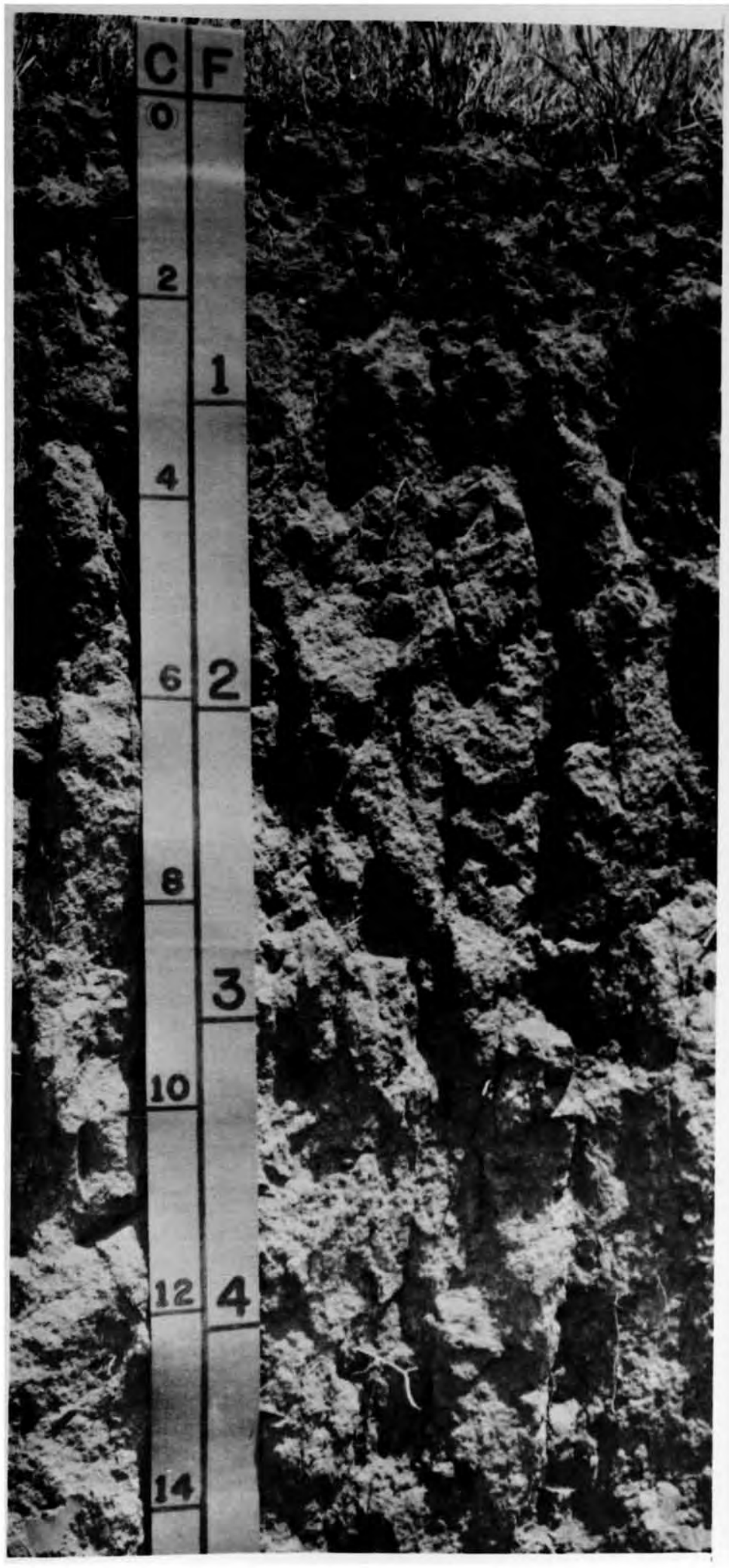

Figure 7.—Profile of Bippus clay loam.

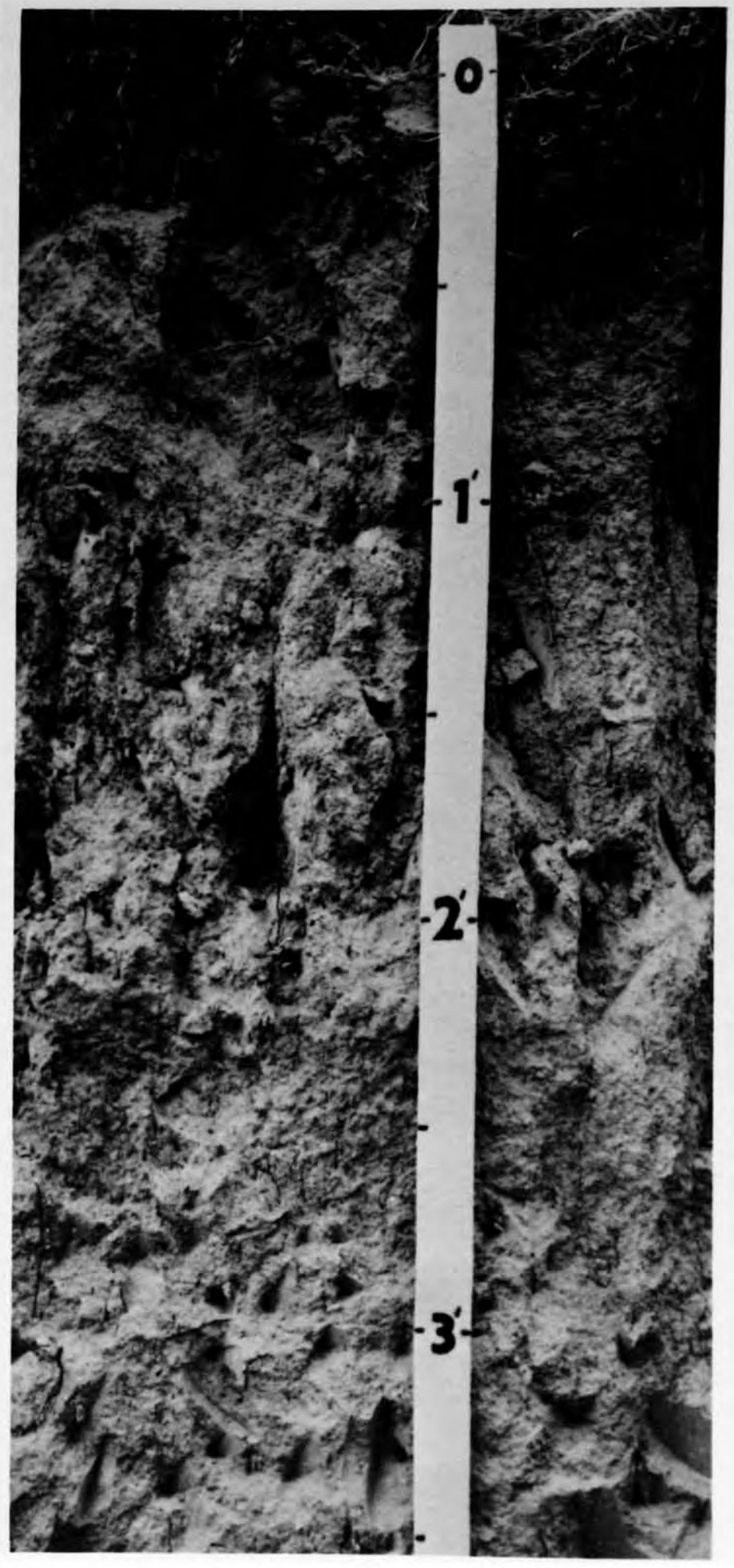

Figure 8.—Profile of Drake clay loam.

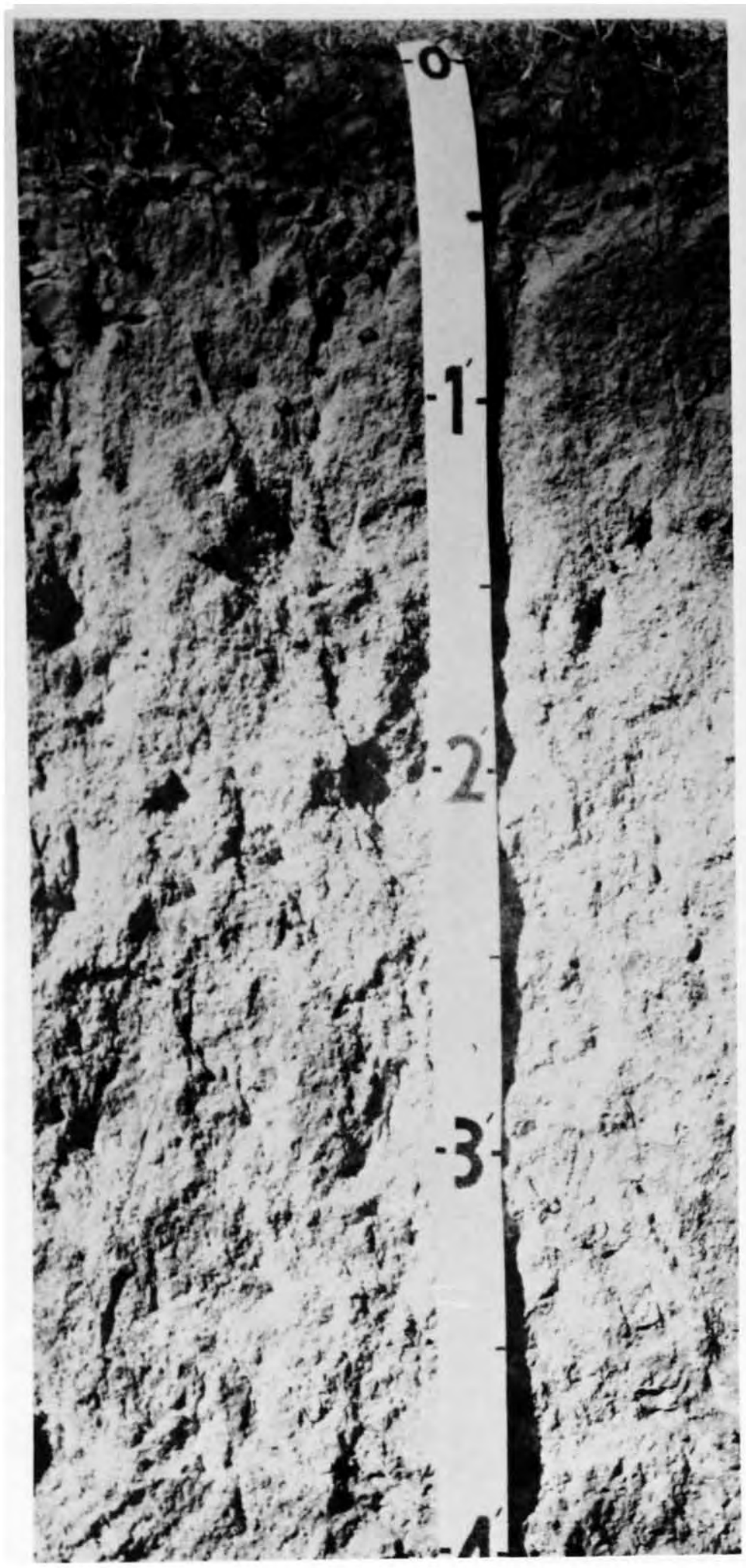

Figure 9.—Profile of Estacado clay loam.

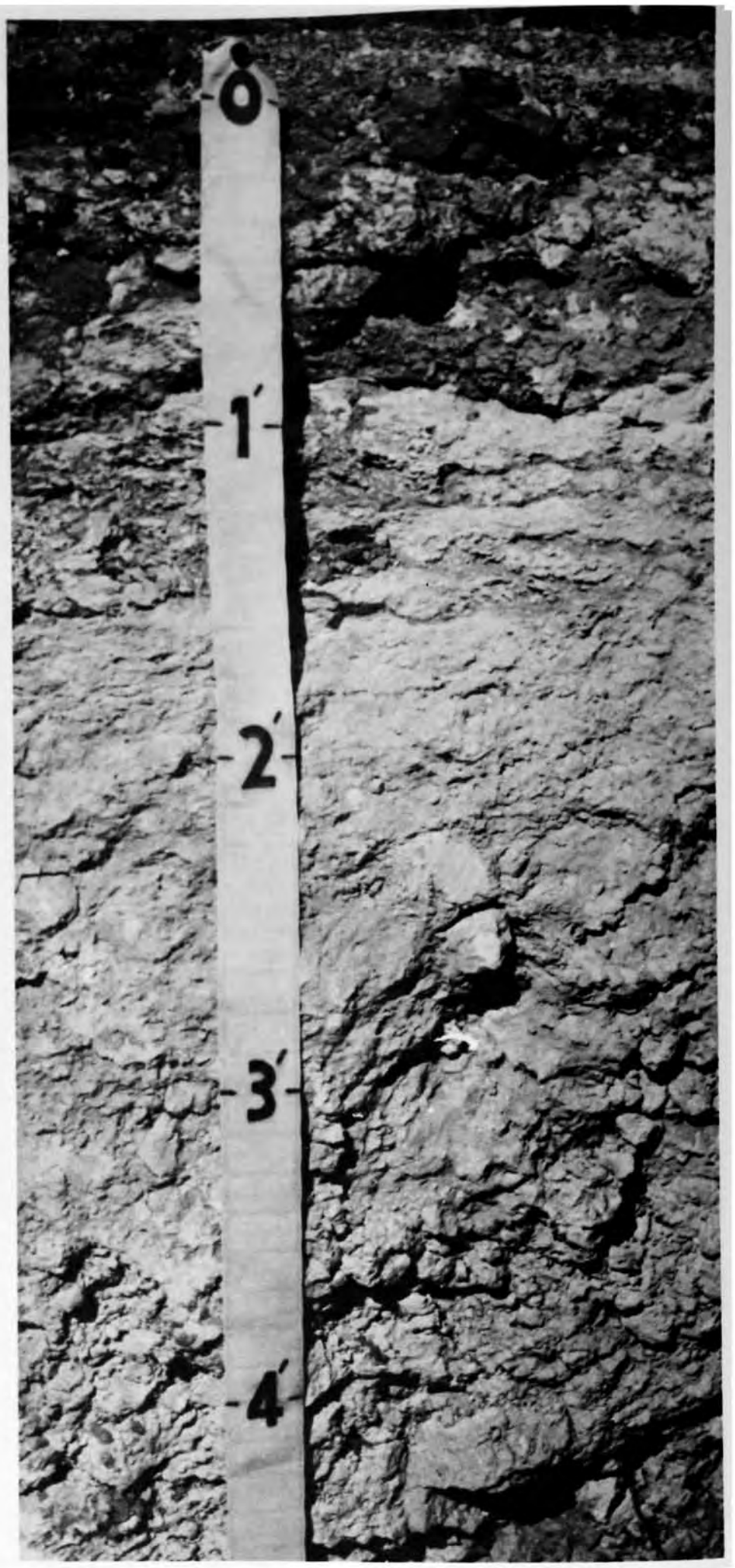

Figure 10.—Profile of Kimbrough loam. Plant roots can penetrate the upper 2 or 3 inches of the caliche through cracks.

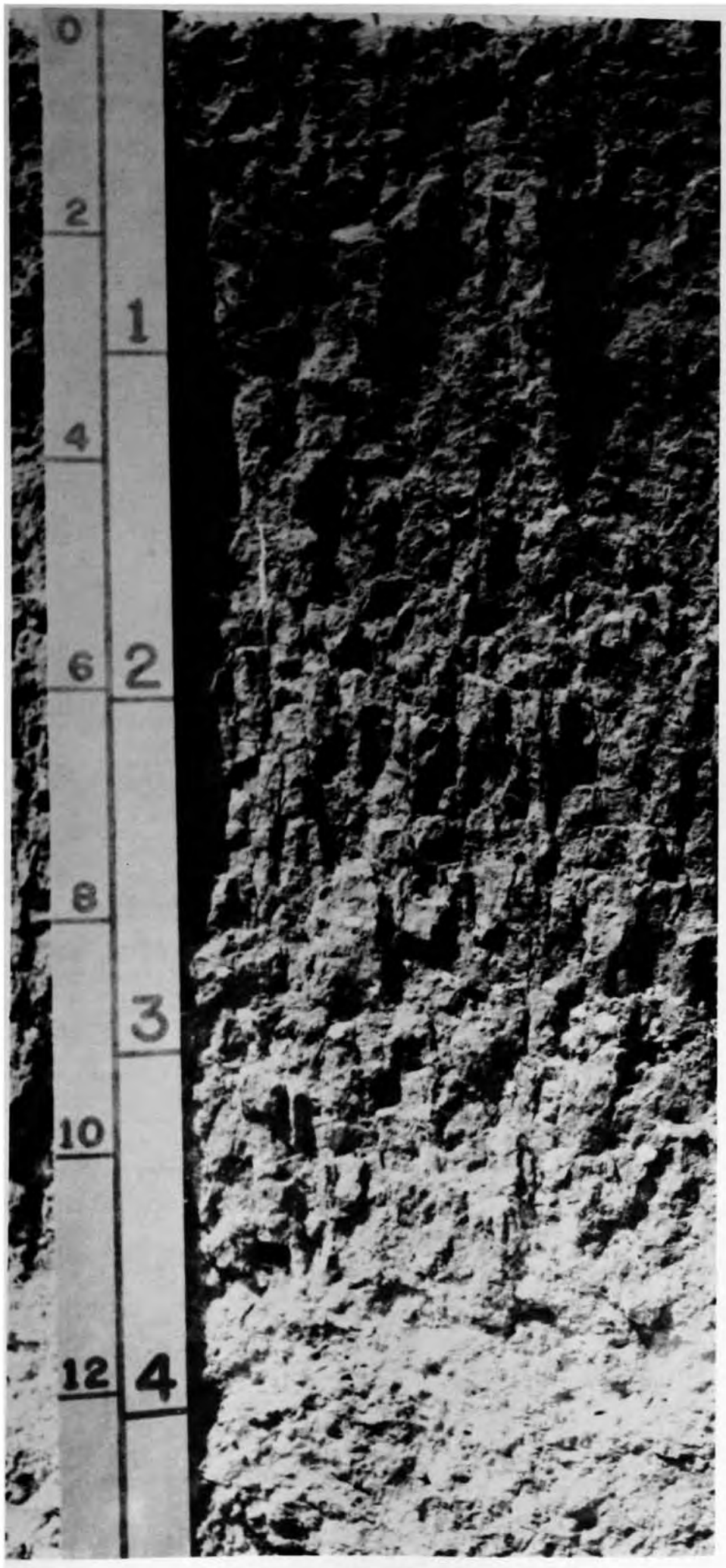

Figure 11.—Profile of Olton clay loam showing the blocky structure at a depth of about 2 feet.

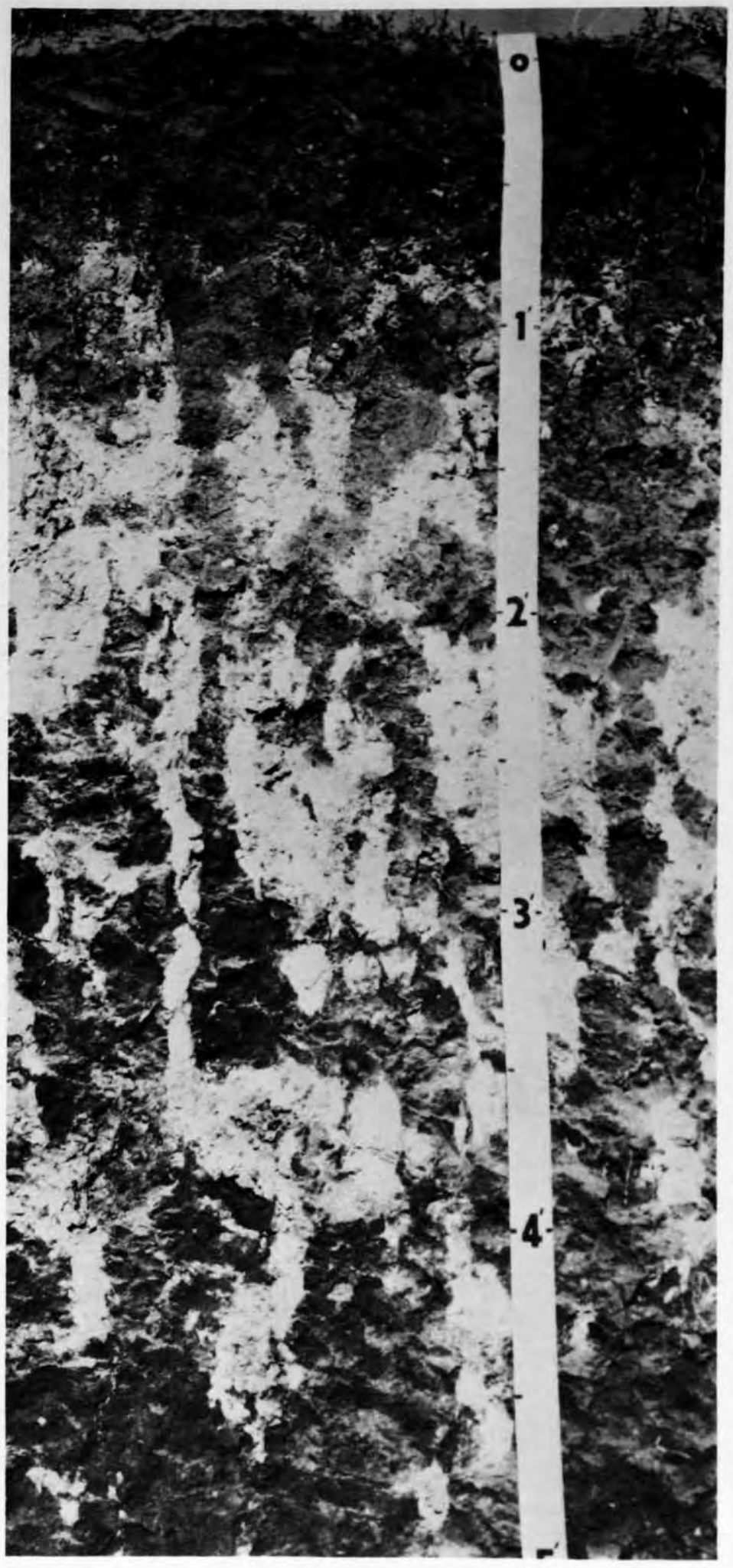

Figure 12.—Profile of Posey fine sandy loam. The light-colored material is calcium carbonate.

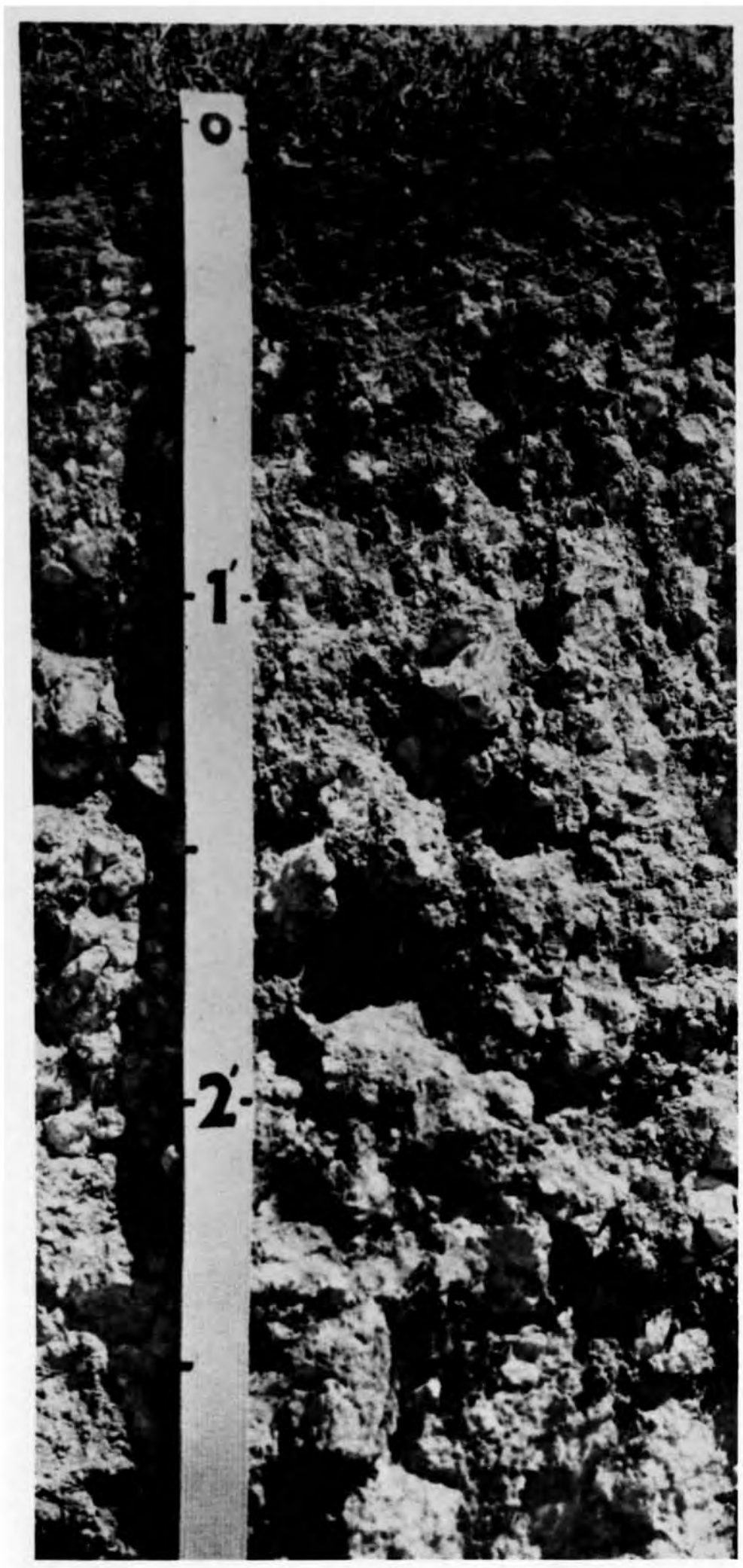

Figure 13.—Profile of Potter loam. Caliche is typically at a depth of about 12 inches.

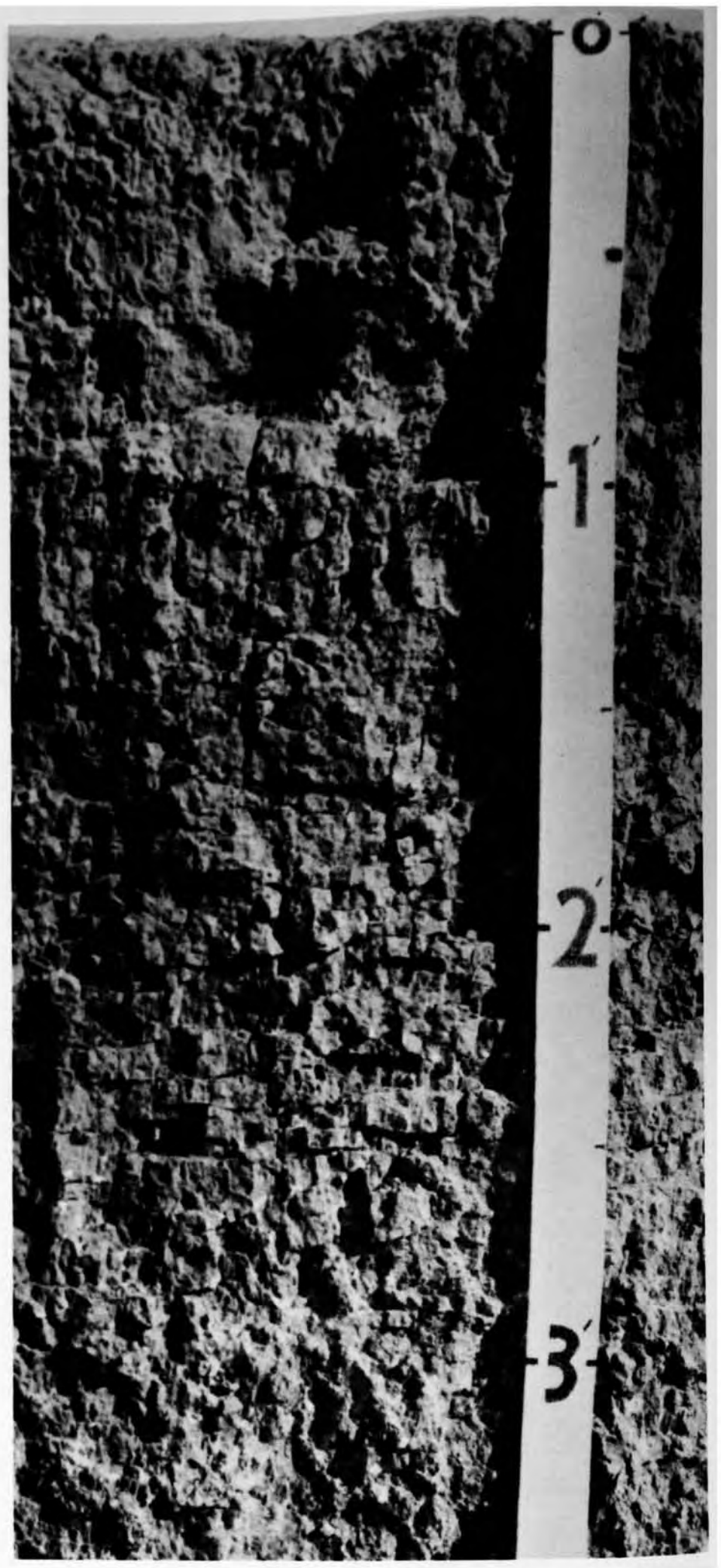

Figure 14.—Profile of Pullman clay showing the blocky structure at about 1 foot to 3 feet.

Figure 15.—Landscape showing gilgai microrelief on Randall clay.

Tables

TABLE 1.--POTENTIALS AND LIMITATIONS OF MAP UNITS FOR SPECIFIED USES

Map unit	Percent of county	Cultivated farm crops	Range	Urban uses	Recreation
1. Amarillo-Acuff	62	High	High	High	High.
2. Olton-Acuff	16	High	Medium: droughty.	Medium: seepage, low strength.	Medium: too clayey, percs slowly.
3. Pullman-Olton	15	High	Medium: droughty.	Low: shrink-swell, corrosivity, low strength.	Medium: too clayey, percs slowly.
4. Potter-Berda-Bippus	4	Low: slope, flooding.	High	Low: slope, erodibility, flooding.	High.
5. Posey-Mansker-Bippus	3	Medium: erodibility, slope, soil blowing.	High	Medium: low strength, slope, corrosivity.	Medium: slope, too clayey.

TABLE 2.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Acuff loam, 0 to 1 percent slopes	109,674	19.2
2	Acuff loam, 1 to 3 percent slopes	13,310	2.3
3	Acuff-Urban land complex, 0 to 2 percent slopes	9,340	1.6
4	Amarillo loamy fine sand, 0 to 3 percent slopes	660	0.1
5	Amarillo fine sandy loam, 0 to 1 percent slopes	78,710	13.8
6	Amarillo fine sandy loam, 1 to 3 percent slopes	26,040	4.6
7	Amarillo-Urban land complex, 0 to 2 percent slopes	11,560	2.0
8	Arch loam, 0 to 3 percent slopes	2,090	0.4
9	Arents and Pits	1,360	0.2
10	Berda loam, 1 to 3 percent slopes	1,420	0.2
11	Berda loam, 3 to 5 percent slopes	1,770	0.3
12	Berda-Potter association, hilly	4,790	0.8
13	Bippus fine sandy loam, frequently flooded	410	0.1
14	Bippus clay loam, occasionally flooded	3,890	0.7
15	Bippus clay loam, frequently flooded	1,290	0.2
16	Drake clay loam, 1 to 3 percent slopes	2,970	0.5
17	Drake clay loam, 3 to 5 percent slopes	1,500	0.3
18	Estacado clay loam, 0 to 1 percent slopes	42,230	7.4
19	Estacado clay loam, 1 to 3 percent slopes	11,910	2.1
20	Estacado-Urban land complex, 0 to 2 percent slopes	3,720	0.7
21	Friona loam, 0 to 1 percent slopes	2,730	0.5
22	Kimbrough loam, 0 to 3 percent slopes	2,450	0.4
23	Lofton clay loam, 0 to 1 percent slopes	8,280	1.4
24	Mansker clay loam, 1 to 3 percent slopes	4,800	0.8
25	Mansker clay loam, 3 to 5 percent slopes	680	0.1
26	Midessa fine sandy loam, 1 to 3 percent slopes	1,820	0.3
27	Mobeetie fine sandy loam, 1 to 3 percent slopes	930	0.2
28	Mobeetie fine sandy loam, 3 to 5 percent slopes	950	0.2
29	Mobeetie fine sandy loam, 5 to 8 percent slopes	1,380	0.2
30	Olton clay loam, 0 to 1 percent slopes	109,420	19.2
31	Olton clay loam, 1 to 3 percent slopes	14,430	2.5
32	Olton-Urban land complex, 0 to 2 percent slopes	470	0.1
33	Portales loam, 0 to 1 percent slopes	3,650	0.6
34	Posey fine sandy loam, 0 to 1 percent slopes	730	0.1
35	Posey fine sandy loam, 1 to 3 percent slopes	5,710	1.0
36	Posey fine sandy loam, 3 to 5 percent slopes	560	0.1
37	Posey fine sandy loam, 5 to 8 percent slopes	410	0.1
38	Potter loam, 2 to 12 percent slopes	5,340	0.9
39	Potter-Berda association, steep	3,780	0.7
40	Potter-Kimbrough-Urban land complex, 1 to 5 percent slopes	1,080	0.2
41	Pullman clay loam, 0 to 1 percent slopes	51,980	9.1
42	Randall clay	15,290	2.7
43	Randall Variant fine sandy loam	590	0.1
44	Urban land	350	0.1
45	Zita fine sandy loam, 0 to 1 percent slopes	670	0.1
46	Zita loam, 0 to 1 percent slopes	3,930	0.7
	Water	466	0.1
	Total	571,520	100.0

TABLE 3.--CAPABILITY CLASSES AND SUBCLASSES

[All soils are assigned to nonirrigated capability subclasses (N). Only those potentially irrigable soils are assigned to irrigated subclasses (I). Miscellaneous areas are excluded. Dashes mean no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
	Acres	Acres	Acres	Acres	Acres
I (N)	---	---	---	---	---
(I)	---	---	---	---	---
II (N)	3,890	---	3,890	---	---
(I)	415,164	351,014	3,890	60,260	---
III (N)	480,204	480,204	---	---	---
(I)	88,320	88,320	---	---	---
IV (N)	22,440	21,850	590	---	---
(I)	3,960	3,960	---	---	---
V (N)	1,700	---	1,700	---	---
VI (N)	18,580	3,290	15,290	---	---
VII (N)	16,360	---	---	16,360	---
VIII(N)	---	---	---	---	---

TABLE 4.--YIELDS PER ACRE OF CROPS

[Yields in columns N are for nonirrigated soils; those in columns I are for irrigated soils. All yields were estimated for a high level of management in 1975. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Cotton lint		Grain sorghum		Wheat		Soybeans	
	N	I	N	I	N	I	N	I
	Lb	Lb	Bu	Bu	Bu	Bu	Bu	Bu
Acuff:								
1	200	900	25	110	18	50	---	40
2	175	750	20	100	16	45	---	30
[1]3	---	---	---	---	---	---	---	---
Amarillo:								
4	225	850	20	100	12	40	---	---
5	250	1,000	25	110	15	50	---	45
6	200	850	20	100	12	45	---	40
[1]7	---	---	---	---	---	---	---	---
Arch:								
8	---	500	---	45	---	---	---	---
Arents:								
[1]9	---	---	---	---	---	---	---	---
Berda:								
10	175	600	20	75	12	45	---	---
11	150	---	15	65	10	40	---	---
[1]12:								
Berda part	---	---	---	---	---	---	---	---
Potter part	---	---	---	---	---	---	---	---
Bippus:								
13, 15	---	---	---	---	---	---	---	---
14	225	900	25	110	18	60	---	45
Drake:								
16	---	---	12	60	10	35	---	---
17	---	---	---	50	---	30	---	---
Estacado:								
18	200	750	25	100	18	45	---	---
19	150	500	20	90	15	40	---	---
[1]20	---	---	---	---	---	---	---	---
Friona:								
21	200	800	25	100	18	50	---	35
Kimbrough:								
22	---	---	---	---	---	---	---	---
Lofton:								
23	190	850	20	140	15	55	---	50
Mansker:								
24	150	350	18	50	12	25	---	---
25	125	---	14	40	10	20	---	---

See footnote at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Cotton lint		Grain sorghum		Wheat		Soybeans	
	N	I	N	I	N	I	N	I
	Lb	Lb	Bu	Bu	Bu	Bu	Bu	Bu
Midessa:								
26	150	700	15	70	12	35	---	---
Mobeetie:								
27	175	650	15	60	12	35	---	---
28	---	---	12	50	10	30	---	---
29	---	---	---	---	---	---	---	---
Olton:								
30	200	850	20	115	16	60	---	40
31	175	780	15	100	14	50	---	30
[1]32	---	---	---	---	---	---	---	---
Portales:								
33	200	750	25	100	18	45	---	---
Posey:								
34	200	750	20	80	15	40	---	---
35	150	600	15	70	12	35	---	---
36	---	---	12	60	10	30	---	---
37	---	---	---	---	---	---	---	---
Potter:								
38	---	---	---	---	---	---	---	---
[1]39:								
Potter part	---	---	---	---	---	---	---	---
Berda part	---	---	---	---	---	---	---	---
[1]40	---	---	---	---	---	---	---	---
Pullman:								
41	200	850	20	125	15	60	---	40
Randall:								
42	---	---	---	---	---	---	---	---
Randall Variant:								
43	---	---	20	---	15	---	---	---
Urban land:								
44	---	---	---	---	---	---	---	---
Zita:								
45	250	1,000	25	110	18	50	---	40
46	225	900	25	110	20	55	---	40

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 5.--RANGE PRODUCTIVITY AND COMPOSITION

[Soils not listed are not in range sites; such soils can be used for grazing if grass cover is established]

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Acuff:					
1, 2	Clay Loam	Favorable	2,100	Blue grama	30
		Normal	1,600	Buffalograss	25
		Unfavorable	1,200	Vine-mesquite	10
				Sideoats grama	5
				Tobosa	5
Amarillo:					
4	Loamy Sand	Favorable	2,800	Little bluestem	30
		Normal	2,000	Sideoats grama	15
		Unfavorable	1,200	Blue grama	5
				Plains bristlegrass	5
				Sand dropseed	5
				Sand bluestem	5
				Sand lovegrass	5
				Hairy grama	5
5, 6	Sandy Loam	Favorable	2,800	Blue grama	30
		Normal	2,100	Sideoats grama	15
		Unfavorable	1,400	Buffalograss	10
				Arizona cottontop	10
				Plains bristlegrass	5
				Little bluestem	5
				Sand dropseed	5
Arch:					
8	High Lime	Favorable	1,150	Alkali sacaton	25
		Normal	900	Black grama	15
		Unfavorable	700	Sideoats grama	10
				Blue grama	10
				Hairy grama	7
				Threeawn	5
				Sand dropseed	5
				Nevada mormontea	5
				Fourwing saltbush	5
Arents:					
[1]9:					
Arents part	Loamy	Favorable	1,500	Sideoats grama	30
		Normal	1,200	Blue grama	20
		Unfavorable	800	Buffalograss	10
				Silver bluestem	5
				Plains bristlegrass	5
				Sand dropseed	5
Pits part.					
Berda:					
10, 11	Hardland Slopes	Favorable	2,800	Sideoats grama	35
		Normal	2,000	Blue grama	20
		Unfavorable	1,200	Little bluestem	5
				Buffalograss	5
				Wright threeawn	5
				Silver bluestem	5
				Plains bristlegrass	5
[1]12:					
Berda part	Hardland Slopes	Favorable	2,800	Sideoats grama	35
		Normal	2,000	Blue grama	20
		Unfavorable	1,200	Little bluestem	5
				Buffalograss	5
				Wright threeawn	5
				Silver bluestem	5
				Plains bristlegrass	5

See footnote at end of table.

TABLE 5.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Berda:					
Potter part	Very Shallow	Favorable	900	Sideoats grama	30
		Normal	700	Blue grama	10
		Unfavorable	400	Little bluestem	10
				Buffalograss	10
				Arizona cottontop	5
				Hairy grama	5
				Black grama	5
Bippus:					
13, 14, 15	Draw	Favorable	3,000	Sideoats grama	25
		Normal	2,400	Vine-mesquite	10
		Unfavorable	1,800	Blue grama	10
				Western wheatgrass	10
				Little bluestem	5
				Arizona cottontop	5
				Plains bristlegrass	5
				White tridens	5
				Buffalograss	5
Drake:					
16, 17	High Lime	Favorable	1,800	Sideoats grama	25
		Normal	1,400	Blue grama	25
		Unfavorable	1,000	Buffalograss	15
				Alkali sacaton	5
				Vine-mesquite	5
				Black grama	5
Estacado:					
18, 19	Loamy	Favorable	2,200	Blue grama	30
		Normal	1,700	Sideoats grama	25
		Unfavorable	1,300	Buffalograss	15
				Vine-mesquite	5
Friona:					
21	Clay Loam	Favorable	2,100	Blue grama	30
		Normal	1,600	Buffalograss	25
		Unfavorable	1,200	Sideoats grama	5
				Tobosa	5
				Vine-mesquite	5
				Hairy grama	5
				Black grama	5
				Sand dropseed	5
Kimbrough:					
22	Very Shallow	Favorable	900	Sideoats grama	30
		Normal	700	Blue grama	10
		Unfavorable	400	Little bluestem	10
				Buffalograss	10
				Arizona cottontop	5
				Hairy grama	5
				Black grama	5
Lofton:					
23	Clay Loam	Favorable	2,200	Blue grama	35
		Normal	1,800	Buffalograss	30
		Unfavorable	1,200	Vine-mesquite	10
				Western wheatgrass	5
				Sand dropseed	5
Mansker:					
24, 25	Loamy	Favorable	2,400	Sideoats grama	30
		Normal	1,750	Blue grama	20
		Unfavorable	1,200	Buffalograss	10
				Silver bluestem	5
				Little bluestem	5
				Vine-mesquite	5
				Plains bristlegrass	5
				Sand dropseed	5

See footnote at end of table.

TABLE 5.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Midessa:					
26	Sandy Loam	Favorable	2,800	Blue grama	30
		Normal	2,100	Sideoats grama	15
		Unfavorable	1,400	Buffalograss	10
				Arizona cottontop	10
				Plains bristlegrass	5
				Little bluestem	5
				Sand dropseed	5
Mobeetie:					
27, 28, 29	Mixedland Slopes	Favorable	3,000	Sideoats grama	30
		Normal	2,250	Blue grama	15
		Unfavorable	1,500	Little bluestem	10
				Sand bluestem	5
				Plains bristlegrass	5
				Sand dropseed	5
				Indiangrass	5
				Hairy grama	5
Olton:					
30, 31	Clay Loam	Favorable	2,100	Blue grama	35
		Normal	1,600	Buffalograss	25
		Unfavorable	1,200	Vine-mesquite	10
				Tobosa	10
				Sideoats grama	5
Portales:					
33	Loamy	Favorable	1,500	Black grama	20
		Normal	1,000	Blue grama	20
		Unfavorable	700	Sideoats grama	15
				Winterfat	10
				Hairy grama	10
				Tobosa	10
				Arizona cottontop	5
				Buffalograss	5
Posey:					
34, 35, 36, 37	Loamy	Favorable	2,800	Sideoats grama	30
		Normal	2,200	Blue grama	20
		Unfavorable	1,400	Vine-mesquite	5
				Little bluestem	5
				Buffalograss	5
				Plains bristlegrass	5
				Sand dropseed	5
Potter:					
38	Very Shallow	Favorable	900	Sideoats grama	30
		Normal	700	Blue grama	10
		Unfavorable	400	Little bluestem	10
				Buffalograss	10
				Arizona cottontop	5
				Hairy grama	5
				Black grama	5
[1]39:					
Potter part	Very Shallow	Favorable	900	Sideoats grama	30
		Normal	700	Blue grama	10
		Unfavorable	400	Little bluestem	10
				Buffalograss	10
				Arizona cottontop	5
				Hairy grama	5
				Black grama	5

See footnote at end of table.

TABLE 5.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Potter:					
Berda part------	Rough Breaks----------	Favorable	1,400	Sideoats grama----------	25
		Normal	800	Little bluestem----------	15
		Unfavorable	400	Hairy grama----------	10
				Sand bluestem----------	5
				Indiangrass----------	5
				Blue grama----------	5
				Black grama----------	5
				Silver bluestem----------	5
Pullman:					
41----------	Clay Loam----------	Favorable	2,000	Blue grama----------	40
		Normal	1,500	Buffalograss----------	25
		Unfavorable	1,000	Sideoats grama----------	5
				Western wheatgrass----------	5
				Vine-mesquite----------	5
				Silver bluestem----------	5
				Tobosa----------	5
Randall:					
42----------	Lakebed----------	Favorable	3,000	Pennsylvania smartweed--------	20
		Normal	1,200	Blue grama----------	15
		Unfavorable	500	Common spikesedge----------	15
				Buffalograss----------	15
				Western wheatgrass----------	10
				Knotgrass----------	5
Randall Variant:					
43----------	Lakebed----------	Favorable	3,500	Pennsylvania smartweed--------	20
		Normal	2,200	Vine-mesquite----------	15
		Unfavorable	1,200	Buffalograss----------	10
				Western wheatgrass----------	10
				Blue grama----------	5
				Knotgrass----------	5
Zita:					
45----------	Sandy Loam----------	Favorable	2,700	Blue grama----------	30
		Normal	2,000	Sideoats grama----------	15
		Unfavorable	1,300	Buffalograss----------	10
				Arizona cottontop----------	10
				Vine-mesquite----------	5
				Sand dropseed----------	5
				Plains bristlegrass----------	5
46----------	Clay Loam----------	Favorable	2,300	Blue grama----------	30
		Normal	1,750	Buffalograss----------	25
		Unfavorable	1,200	Vine-mesquite----------	10
				Tobosa----------	10
				Sideoats grama----------	5
				Sand dropseed----------	5

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 6.--BUILDING SITE DEVELOPMENT

["Depth to rock" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Acuff:					
1, 2	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
[1]3:					
Acuff part	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
Urban land part.					
Amarillo:					
4, 5, 6	Slight	Slight	Slight	Slight	Moderate: low strength.
[1]7:					
Amarillo part	Slight	Slight	Slight	Slight	Moderate: low strength.
Urban land part.					
Arch:					
8	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Arents:					
[1]9:					
Arents part	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
Pits part.					
Berda:					
10	Slight	Slight	Slight	Slight	Slight.
11	Slight	Slight	Slight	Moderate: slope.	Slight.
[1]12:					
Berda part	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Potter part	Severe: slope.	Severe: slope.	Severe: depth to rock.	Severe: slope.	Severe: slope.
Bippus:					
13, 14, 15	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Drake:					
16	Moderate: too clayey.	Slight: slope.	Slight	Slight	Moderate: low strength.
17	Moderate: too clayey.	Slight: slope.	Slight	Moderate: slope.	Moderate: low strength.
Estacado:					
18, 19	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
[1]20:					
Estacado part	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.

See footnote at end of table.

TABLE 6.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Estacado: Urban land part.					
Friona: 21	Moderate: cemented pan.	Moderate: cemented pan, low strength.	Moderate: cemented pan, low strength.	Moderate: cemented pan, low strength.	Moderate: low strength.
Kimbrough: 22	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.
Lofton: 23	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
Mansker: 24, 25	Moderate: too clayey.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
Midessa: 26	Slight	Slight	Slight	Slight	Moderate: low strength.
Mobeetie: 27	Slight	Slight	Slight	Slight	Slight.
28, 29	Slight	Slight	Slight	Moderate: slope.	Slight.
Olton: 30, 31	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength, shrink-swell.
[1]32: Olton part	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength, shrink-swell.
Urban land part.					
Portales: 33	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.
Posey: 34, 35	Slight	Slight	Slight	Slight	Slight.
36, 37	Slight	Slight	Slight	Moderate: slope.	Slight.
Potter: 38	Moderate: small stones.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
[1]39: Potter part	Severe: slope.	Severe: slope.	Severe: depth to rock.	Severe: slope.	Severe: slope.
Berda part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]40: Potter part	Moderate: small stones.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.

See footnote at end of table.

TABLE 6.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Potter:					
Kimbrough part-	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.
Urban land part.					
Pullman:					
41----------	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Randall:					
42----------	Severe: too clayey, wetness.	Severe: shrink-swell, wetness, floods.	Severe: shrink-swell, wetness, floods.	Severe: shrink-swell, wetness, floods.	Severe: shrink-swell, wetness, floods.
Randall Variant:					
43----------	Severe: wetness, too clayey, floods.	Severe: wetness, shrink-swell, floods.	Severe: wetness, shrink-swell, floods.	Severe: wetness, shrink-swell, floods.	Severe: wetness, shrink-swell, floods.
Urban land:					
44.					
Zita:					
45, 46----------	Moderate: too clayey.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 7.--SANITARY FACILITIES

["Depth to rock" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Acuff:					
1, 2	Slight	Moderate: seepage.	Slight	Slight	Good.
[1]3:					
Acuff part	Slight	Moderate: seepage.	Slight	Slight	Good.
Urban land part.					
Amarillo:					
4, 5, 6	Slight	Moderate: seepage.	Slight	Slight	Good.
[1]7:					
Amarillo part	Slight	Moderate: seepage.	Slight	Slight	Good.
Urban land part.					
Arch:					
8	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Arents:					
[1]9:					
Arents part	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Pits part.					
Berda:					
10, 11	Slight	Moderate: slope. seepage.	Slight	Slight	Good.
[1]12:					
Berda part	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
Potter part	Severe: slope, seepage.	Severe: slope.	Moderate: small stones.	Severe: slope.	Poor: thin layer.
Bippus:					
13	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
14, 15	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
Drake:					
16, 17	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: seepage, too clayey.	Slight	Good.
Estacado:					
18, 19	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
[1]20:					
Estacado part	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Urban land part.					

See footnote at end of table.

TABLE 7.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Friona:					
21	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Slight	Fair: thin layer.
Kimbrough:					
22	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Poor: thin layer, area reclaim.
Lofton:					
23	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
Mansker:					
24, 25	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Midessa:					
26	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Mobeetie:					
27, 28, 29	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
Olton:					
30	Moderate: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
31	Moderate: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
[1]32:					
Olton part	Moderate: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Urban land part.					
Portales:					
33	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Fair: area reclaim.
Posey:					
34	Slight	Moderate: seepage.	Slight	Slight	Good.
35, 36, 37	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
Potter:					
38	Severe: seepage.	Severe: slope.	Moderate: small stones.	Slight	Poor: thin layer.
[1]39:					
Potter part	Severe: slope, seepage.	Severe: slope.	Moderate: small stones.	Severe: slope.	Poor: thin layer.
Berda part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
[1]40:					
Potter part	Severe: seepage.	Moderate: seepage.	Moderate: small stones.	Slight	Poor: thin layer.

See footnote at end of table.

TABLE 7.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Potter:					
Kimbrough part---	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight----------	Poor: thin layer, area reclaim.
Urban land part.					
Pullman:					
41----------	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey.
Randall:					
42----------	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: floods.	Poor: too clayey. wetness.
Randall Variant:					
43----------	Severe: wetness, percs slowly, floods.	Slight----------	Severe: wetness, too clayey, floods.	Severe: wetness, floods.	Poor: wetness, too clayey.
Urban land:					
44.					
Zita:					
45, 46----------	Slight----------	Moderate: seepage.	Slight----------	Slight----------	Good.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 8.--CONSTRUCTION MATERIALS

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Acuff:				
1, 2	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
[1]3:				
Acuff part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Urban land part.				
Amarillo:				
4	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
5, 6	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
[1]7:				
Amarillo part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Urban land part.				
Arch:				
8	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess lime.
Arents:				
[1]9:				
Arents part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess lime.
Pits part.				
Berda:				
10, 11	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
[1]12:				
Berda part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Potter part	Fair: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Bippus:				
13	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
14, 15	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Drake:				
16, 17	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
Estacado:				
18, 19	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, excess lime.

See footnote at end of table.

TABLE 8.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Estacado:				
[1]20:				
Estacado part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, excess lime.
Urban land part.				
Friona:				
21	Fair: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
Kimbrough:				
22	Poor: area reclaim, thin layer.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Poor: area reclaim, excess lime, small stones.
Lofton:				
23	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Mansker:				
24, 25	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, excess lime.
Midessa:				
26	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Mobeetie:				
27, 28, 29	Good	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Olton:				
30, 31	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
[1]32:				
Olton part	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Urban land part.				
Portales:				
33	Fair: low strength, area reclaim, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime, area reclaim.
Posey:				
34, 35, 36, 37	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, excess lime.
Potter:				
38	Good:	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Poor: thin layer, small stones.
[1]39:				
Potter part	Fair: slope.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Poor: thin layer, small stones.
Berda part	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 8.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Potter: 140:				
Potter part	Good	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Poor: thin layer, small stones.
Kimbrough part	Poor: area reclaim, thin layer.	Unsuited: excess fines, thin layer.	Unsuited: excess fines, thin layer.	Poor: area reclaim, excess lime, small stones.
Urban land part.				
Pullman: 41	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Randall: 42	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Randall Variant: 43	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Urban land: 44.				
Zita: 45, 46	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 9.--WATER MANAGEMENT

["Seepage" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Grassed waterways
Acuff:					
1, 2	Moderate: seepage.	Moderate: seepage.	Erodes easily	Favorable	Favorable.
13:					
Acuff part	Moderate: seepage.	Moderate: seepage.	Erodes easily	Favorable	Favorable.
Urban land part.					
Amarillo:					
4	Moderate: seepage.	Moderate: seepage, piping.	Erodes easily, too sandy.	Too sandy	Favorable.
5, 6	Moderate: seepage.	Moderate: seepage, piping.	Erodes easily	Favorable	Favorable.
17:					
Amarillo part	Moderate: seepage.	Moderate: seepage, piping.	Erodes easily	Favorable	Favorable.
Urban land part.					
Arch:					
8	Moderate: seepage.	Moderate: low strength.	Erodes easily, soil blowing, excess lime.	Erodes easily	Erodes easily, droughty.
Arents:					
19:					
Arents part	Severe: seepage.	Moderate: low strength, seepage.	Slope, droughty, excess lime.	Erodes easily, slope.	Erodes easily, droughty, slope.
Pits part.					
Berda:					
10, 11	Moderate: seepage.	Moderate: piping, erodes easily.	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
112:					
Berda part	Moderate: seepage.	Moderate: piping, erodes easily.	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Potter part	Severe: seepage.	Severe: thin layer, seepage.	Rooting depth, droughty, complex slope.	Complex slope, depth to rock.	Droughty, rooting depth, slope.
Bippus:					
13, 15	Moderate: seepage.	Moderate: low strength, shrink-swell.	Floods	Favorable	Favorable.
14	Moderate: seepage.	Moderate: low strength, shrink-swell.	Favorable	Favorable	Favorable.

See footnote at end of table.

TABLE 9.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Grassed waterways
Drake: 16, 17	Moderate: seepage.	Moderate: compressible, piping.	Complex slope, droughty, erodes easily.	Complex slope, erodes easily.	Droughty, erodes easily.
Estacado: 18, 19	Moderate: seepage.	Moderate: seepage, low strength.	Erodes easily	Favorable	Favorable.
[1]20: Estacado part	Moderate: seepage.	Moderate: seepage, low strength.	Erodes easily	Favorable	Favorable.
Urban land part.					
Friona: 21	Severe: cemented pan, seepage.	Moderate: thin layer.	Rooting depth	Cemented pan, rooting depth.	Rooting depth.
Kimbrough: 22	Severe: cemented pan.	Severe: thin layer, piping.	Droughty, excess lime, rooting depth.	Cemented pan, rooting depth.	Droughty, rooting depth.
Lofton: 23	Slight	Moderate: compressible.	Slow intake	Not needed	Favorable.
Mansker: 24, 25	Moderate: seepage.	Moderate: piping, seepage.	Slope, erodes easily. excess lime.	Slope, erodes easily.	Droughty, erodes easily, slope.
Midessa: 26	Moderate: seepage.	Moderate: seepage, piping.	Erodes easily, fast intake.	Erodes easily	Erodes easily.
Mobeetie: 27, 28, 29	Severe: seepage.	Moderate: piping, seepage.	Complex slope, fast intake, erodes easily.	Complex slope, erodes easily, too sandy.	Droughty, erodes easily, slope.
Olton: 30, 31	Moderate: seepage.	Moderate: piping.	Slow intake	Favorable	Favorable.
[1]32: Olton part	Moderate: seepage.	Moderate: piping.	Slow intake	Favorable	Favorable.
Urban land part.					
Portales: 33	Moderate: seepage.	Moderate: low strength, compressible, piping.	Soil blowing, excess lime.	Soil blowing	Droughty.
Posey: 34, 35, 36, 37	Moderate: seepage.	Moderate: piping, seepage.	Slope, excess lime, erodes easily.	Slope, erodes easily.	Slope, erodes easily.

See footnote at end of table.

TABLE 9.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Irrigation	Terraces and diversions	Grassed waterways
Potter: 38	Severe: seepage.	Severe: thin layer, seepage.	Rooting depth, droughty, complex slope.	Complex slope, depth to rock.	Droughty, rooting depth, slope.
[1]39: Potter part	Severe: seepage.	Severe: thin layer, seepage.	Rooting depth, droughty, complex slope.	Complex slope, depth to rock.	Droughty, rooting depth, slope.
Berda part	Moderate: seepage.	Moderate: piping, erodes easily.	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
[1]40: Potter part	Severe: seepage.	Severe: thin layer, seepage.	Rooting depth, droughty, complex slope.	Complex slope, depth to rock.	Droughty, rooting depth, slope.
Kimbrough part	Severe: cemented pan.	Severe: thin layer, piping.	Droughty, excess lime, rooting depth.	Cemented pan, rooting depth.	Droughty, rooting depth.
Urban land part.					
Pullman: 41	Slight	Moderate: shrink-swell, low strength.	Slow intake	Favorable	Favorable.
Randall: 42	Slight	Moderate: unstable fill, hard to pack.	Slow intake, wetness.	Not needed	Not needed.
Randall Variant: 43	Slight	Moderate: unstable fill.	Wetness, floods.	Not needed	Not needed.
Urban land: 44.					
Zita: 45, 46	Moderate: seepage.	Moderate: seepage.	Favorable	Favorable	Favorable.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Acuff:				
1	Slight	Slight	Slight	Slight.
2	Slight	Slight	Moderate: slope.	Slight.
[1]3:				
Acuff part	Slight	Slight	Slight	Slight.
Urban land part.				
Amarillo:				
4	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
5	Slight	Slight	Slight	Slight.
6	Slight	Slight	Moderate: slope.	Slight.
[1]7:				
Amarillo part	Slight	Slight	Slight	Slight.
Urban land part.				
Arch:				
8	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
Arents:				
[1]9:				
Arents part	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
Pits part.				
Berda:				
10, 11	Slight	Slight	Moderate: slope.	Slight.
[1]12:				
Berda part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Potter part	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Bippus:				
13, 14, 15	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
Drake:				
16, 17	Moderate: dusty.	Moderate: dusty.	Moderate: dusty, slope.	Moderate: dusty.
Estacado:				
18	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
19	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope.	Moderate: too clayey.
[1]20:				
Estacado part	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Estacado: Urban land part.				
Friona: 21	Slight	Slight	Moderate: depth to rock.	Slight.
Kimbrough: 22	Slight	Slight	Severe: cemented pan.	Slight.
Lofton: 23	Severe: percs slowly.	Moderate: too clayey, wetness.	Severe: percs slowly.	Moderate: too clayey.
Mansker: 24, 25	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope.	Moderate: too clayey.
Midessa: 26	Slight	Slight	Moderate: slope.	Slight.
Mobeetie: 27, 28	Slight	Slight	Moderate: slope.	Slight.
29	Slight	Slight	Severe: slope.	Slight.
Olton: 30, 31	Moderate: percs slowly.	Moderate: too clayey.	Moderate: percs slowly.	Moderate: too clayey.
[1]32: Olton part	Moderate: percs slowly.	Moderate: too clayey.	Moderate: percs slowly.	Moderate: too clayey.
Urban land part.				
Portales: 33	Slight	Slight	Slight	Slight.
Posey: 34	Slight	Slight	Slight	Slight.
35, 36	Slight	Slight	Moderate: slope.	Slight.
37	Slight	Slight	Severe: slope.	Slight.
Potter: 38	Slight	Slight	Severe: slope.	Slight.
[1]39: Potter part	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Berda part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
[1]40: Potter part	Slight	Slight	Moderate: slope, small stones.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Potter: Kimbrough part	Slight	Slight	Severe: cemented pan.	Slight.
Urban land part.				
Pullman: 41	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Moderate: percs slowly, too clayey.	Moderate: too clayey.
Randall: 42	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
Randall Variant: 43	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Urban land: 44.				
Zita: 45, 46	Slight	Slight	Slight	Slight.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 11.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Acuff:									
1, 2	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
[1]3:									
Acuff part	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Urban land part.									
Amarillo:									
4	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
5, 6	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
[1]7:									
Amarillo part	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Urban land part.									
Arch:									
8	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Arents:									
[1]9:									
Arents part	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.	Poor	Very poor.	Fair.
Pits part.									
Berda:									
10, 11	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
[1]12:									
Berda part	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Potter part	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Bippus:									
13, 15	Very poor.	Poor	Fair	Good	Very poor.	Very poor.	Poor	Very poor.	Fair.
14	Good	Good	Good	Good	Very poor.	Very poor.	Good	Very poor.	Good.
Drake:									
16, 17	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Estacado:									
18, 19	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
[1]20:									
Estacado part	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Urban land part.									

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Friona: 21	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Kimbrough: 22	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Lofton: 23	Fair	Good	Fair	Fair	Poor	Poor	Fair	Poor	Fair.
Mansker: 24, 25	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Midessa: 26	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Mobeetie: 27, 28	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
29	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Olton: 30, 31	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
[1]32: Olton part	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Urban land part.									
Portales: 33	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Posey: 34, 35, 36	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
37	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
Potter: 38	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
[1]39: Potter part	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Berda part	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.	Poor	Very poor.	Fair.
[1]40: Potter part	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Kimbrough part	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Urban land part.									
Pullman: 41	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Randall: 42	Poor	Poor	Fair	Poor	Poor	Fair	Poor	Poor	Poor.
Randall Variant: 43	Poor	Poor	Fair	Fair	Fair	Fair	Poor	Fair	Fair.
Urban land: 44.									
Zita: 45, 46	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 12.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[Absence of an entry means the species does not grow well on the soil]

Soil name and map symbol	Expected heights of specified trees at 20 years of age							
	Siberian elm	Honey-locust	Russian-olive	Eastern redcedar	Oriental arbor-vitae	Arizona cypress	Green ash	Osage-orange
	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft
Acuff:								
1, 2	30	25	12	15	18	15	15	15
[1]3:								
Acuff part	30	25	12	15	18	15	15	15
Urban land part.								
Amarillo:								
4, 5, 6	35	30	15	15	20	20	20	20
[1]7:								
Amarillo part	35	30	15	15	20	20	20	20
Urban land part.								
Arch:								
8.								
Arents:								
[1]9:								
Arents part.								
Pits part.								
Berda:								
10, 11	30	--	--	15	15	--	--	15
[1]12:								
Berda part	30	--	--	15	15	--	--	15
Potter part.								
Bippus:								
13, 14, 15	35	30	15	15	20	20	20	20
Drake:								
16, 17.								
Estacado:								
18, 19	30	--	--	15	15	--	--	15
[1]20:								
Estacado part	30	--	--	15	15	--	--	15
Urban land part.								
Friona:								
21.								
Kimbrough:								
22.								
Lofton:								
23	30	25	15	20	20	--	--	--
Mansker:								
24, 25.								
Midessa:								
26	35	30	15	15	18	20	20	20
Mobeetie:								
27, 28, 29	35	25	15	15	20	20	20	15

See footnote at end of table.

TABLE 12.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Expected heights of specified trees at 20 years of age							
	Siberian elm	Honey-locust	Russian-olive	Eastern redcedar	Oriental arbor-vitae	Arizona cypress	Green ash	Osage-orange
	Ft	Ft	Ft	Ft	Ft	Ft	Ft	Ft
Olton:								
30, 31	30	25	12	15	18	15	15	15
[1]32:								
Olton part	30	25	12	15	18	15	15	15
Urban land part.								
Portales:								
33.								
Posey:								
34, 35, 36, 37	30	25	--	15	15	20	--	15
Potter:								
38.								
[1]39:								
Potter part.								
Berda part	30	--	--	15	15	--	--	15
[1]40:								
Potter part.								
Kimbrough part.								
Urban land part.								
Pullman:								
41	30	25	12	20	18	20	--	15
Randall:								
42.								
Randall Variant:								
43.								
Urban land:								
44.								
Zita:								
45, 46	30	25	15	20	20	--	15	15

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Acuff:											
1, 2	0-12	Loam	CL	A-4, A-6	0	100	95-100	95-100	51-70	24-32	10-16
	12-38	Clay loam, sandy clay loam, loam.	CL	A-6, A-7-6	0	100	95-100	95-100	65-75	28-45	12-25
	38-80	Clay loam, sandy clay loam, loam.	CL	A-6, A-7-6	0	95-100	90-100	90-100	60-75	25-42	12-25
[1]3:											
Acuff part	0-12	Loam	CL	A-4, A-6	0	100	95-100	95-100	51-70	24-32	10-16
	12-38	Clay loam, sandy clay loam, loam.	CL	A-6, A-7-6	0	100	95-100	95-100	65-75	28-45	12-25
	38-80	Clay loam, sandy clay loam, loam.	CL	A-6, A-7-6	0	95-100	90-100	90-100	60-75	25-42	12-25
Urban land part.											
Amarillo:											
4	0-14	Loamy fine sand	SM, SM-SC	A-2-4	0	100	100	95-100	15-35	<22	NP-4
	14-46	Sandy clay loam, clay loam.	SC, SM-SC, CL	A-4, A-6, A-2-4	0	100	100	95-100	35-65	20-40	7-20
	46-80	Sandy clay loam, clay loam.	SC, CL, SM-SC	A-4, A-6, A-2-4	0	90-100	90-100	65-98	35-70	20-35	7-17
5, 6	0-14	Fine sandy loam	SM, SM-SC, CL-ML	A-2-4, A-4	0	100	100	95-100	35-55	17-25	3-7
	14-46	Sandy clay loam, clay loam.	SC, SM-SC, CL	A-4, A-6, A-2-4	0	100	100	95-100	35-65	20-40	7-20
	46-80	Sandy clay loam, clay loam.	SC, CL, SM-SC	A-4, A-6, A-2-4	0	90-100	90-100	65-98	35-70	20-35	7-17
[1]7:											
Amarillo part	0-14	Fine sandy loam	SM, SM-SC, CL-ML	A-2-4, A-4	0	100	100	95-100	35-55	17-25	3-7
	14-46	Sandy clay loam, clay loam.	SC, SM-SC, CL	A-4, A-6, A-2-4	0	100	100	95-100	35-65	20-40	7-20
	46-80	Sandy clay loam, clay loam.	SC, CL, SM-SC	A-4, A-6, A-2-4	0	90-100	90-100	65-98	35-70	20-35	7-17
Urban land part.											
Arch:											
8	0-9	Loam	CL-ML	A-4	0	100	100	85-95	60-75	25-30	5-10
	9-17	Loam, clay loam, sandy clay loam.	CL, CL-ML	A-6, A-4	0	100	100	85-95	50-65	25-35	5-15
	17-62	Loam, clay loam	CL	A-6	0	100	100	90-100	70-80	30-40	10-20
Arents:											
[1]9:											
Arents part.											
Pits part.											

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Berda:											
10, 11	0-8	Loam	SC, CL, SM-SC, CL-ML	A-4, A-6	0-3	85-100	85-100	75-95	36-70	20-35	7-20
	8-58	Loam, clay loam, sandy clay loam.	SC, CL, SM-SC, CL-ML	A-4, A-6	0	85-100	85-100	75-95	40-75	20-35	7-20
[1]12:											
Berda part	0-8	Loam	SC, CL, SM-SC, CL-ML	A-4, A-6	0-3	85-100	85-100	75-95	36-70	20-35	7-20
	8-58	Loam, clay loam, sandy clay loam.	SC, CL, SM-SC, CL-ML	A-4, A-6	0	85-100	85-100	75-95	40-75	20-35	7-20
Potter part	0-12	Gravelly loam	CL, ML, CL-ML	A-4, A-6	0-5	70-95	70-95	60-85	51-70	20-40	5-20
	12-30	Variable	GM, GC, SM, SC	A-2-4, A-4, A-6, A-2-6	5-50	30-80	25-75	20-60	13-50	20-40	5-20
Bippus:											
13	0-8	Fine sandy loam	CL-ML, CL, SC, SM-SC	A-2-4, A-4	0	100	95-100	80-98	30-60	18-25	4-10
	8-72	Clay loam, loam, sandy clay loam.	SC, CL, SM-SC	A-4, A-6	0	100	95-100	85-98	36-75	22-40	7-20
14, 15	0-8	Clay loam	CL, SC, SM-SC	A-4, A-6	0	100	95-100	85-98	36-80	22-40	7-20
	8-72	Clay loam, loam, sandy clay loam.	SC, CL, SM-SC	A-4, A-6	0	100	95-100	85-98	36-75	22-40	7-20
Drake:											
16, 17	0-60	Clay loam	CL, SC, ML, CL-ML	A-4, A-6	0	100	100	70-90	40-70	20-35	4-15
Estacado:											
18, 19	0-16	Clay loam	CL	A-6, A-4	0	95-100	95-100	55-100	51-90	25-40	8-20
	16-26	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	95-100	85-100	55-90	30-42	12-25
	26-66	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	95-100	80-100	60-95	30-45	13-25
[1]20:											
Estacado part	0-16	Clay loam	CL	A-6, A-4	0	95-100	95-100	55-100	51-90	25-40	8-20
	16-26	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	95-100	85-100	55-90	30-42	12-25
	26-66	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	95-100	80-100	60-95	30-45	13-25
Urban land part.											
Friona:											
21	0-8	Loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	51-70	24-35	7-15
	8-26	Sandy clay loam, clay loam, loam.	CL	A-6, A-7-6	0	100	100	90-100	60-75	30-45	12-25
	26-32	Indurated	---	---	---	---	---	---	---	---	---
	32-60	Variable	---	---	---	---	---	---	---	---	---
Kimbrough:											
22	0-11	Loam	SM, ML, CL-ML	A-4	0-10	80-90	75-85	65-80	45-65	20-30	NP-10
	11-14	Indurated	---	---	---	---	---	---	---	---	---
	14-34	Variable	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Lofton:											
23----------	0-10	Clay loam-------	CL	A-6, A-7-6	0	100	100	98-100	70-90	35-45	15-25
	10-50	Clay, silty clay	CL	A-6, A-7-6	0	100	100	95-100	70-90	38-50	20-30
	50-72	Clay, silty clay, silty clay loam.	CL	A-6, A-7-6	0	100	95-100	90-100	60-80	30-45	15-25
Mansker:											
24, 25----------	0-8	Clay loam-------	CL, CL-ML, SC, SM-SC	A-4, A-6	0	95-100	95-100	80-98	40-75	20-37	5-20
	8-32	Loam, clay loam	CL, SC	A-4, A-6	0	90-100	90-100	85-98	40-80	22-40	7-22
	32-60	Clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	98-100	95-100	85-100	45-85	22-40	7-22
Midessa:											
26----------	0-7	Fine sandy loam	SM, SM-SC, CL, SC	A-2-4, A-4	0	95-100	95-100	85-100	30-55	17-27	4-9
	7-23	Sandy clay loam	CL, SC, SM-SC, CL-ML	A-6, A-4	0	95-100	95-100	90-100	36-80	22-35	7-17
	23-66	Sandy clay loam, clay loam.	CL, SC, SM-SC, CL-ML	A-6, A-4	0	90-100	85-100	80-100	40-80	22-35	7-17
Mobeetie:											
27, 28, 29--------	0-72	Fine sandy loam	CL-ML, SM-SC, SM, ML	A-4, A-2-4	0-5	90-100	90-98	80-95	30-65	18-25	2-7
Olton:											
30, 31----------	0-10	Clay loam-------	CL	A-4, A-6	0	100	95-100	85-100	55-80	25-35	8-18
	10-42	Clay loam, silty clay loam, clay.	CL	A-6, A-7-6	0	95-100	90-100	90-100	60-95	35-50	18-32
	42-80	Clay loam, sandy clay loam, loam.	CL	A-4, A-6	0	90-100	85-100	80-100	60-85	20-40	8-25
[1]32:											
Olton part------	0-10	Clay loam-------	CL	A-4, A-6	0	100	95-100	85-100	55-80	25-35	8-18
	10-42	Clay loam, silty clay loam, clay.	CL	A-6, A-7-6	0	95-100	90-100	90-100	60-95	35-50	18-32
	42-80	Clay loam, sandy clay loam, loam.	CL	A-4, A-6	0	90-100	85-100	80-100	60-85	20-40	8-25
Urban land part.											
Portales:											
33----------	0-14	Loam----------	CL-ML, CL	A-4, A-6	0	100	95-100	90-100	60-80	25-35	5-15
	14-80	Loam, clay loam	CL	A-6	0	100	95-100	90-100	60-80	25-40	10-20
Posey:											
34, 35, 36, 37----	0-10	Fine sandy loam	CL, SM-SC, CL-ML, SC	A-4, A-2-4	0	98-100	95-100	85-100	30-55	17-27	4-9
	10-39	Sandy clay loam, clay loam.	CL, SC, SM-SC, CL-ML	A-4, A-6	0	85-100	85-100	80-100	45-80	22-40	7-22
	39-80	Sandy clay loam, clay loam.	CL	A-4, A-6	0	85-100	85-100	80-100	51-75	25-40	8-22

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Potter:											
38	0-12	Loam	CL, ML, CL-ML	A-4, A-6	0-5	70-95	70-95	60-85	51-70	20-40	5-20
	12-30	Variable	GM, GC SM, SC	A-2-4, A-4, A-6, A-2-6	5-50	30-80	25-75	20-60	13-50	20-40	5-20
[1]39:											
Potter part	0-12	Loam	CL, ML, CL-ML	A-4, A-6	0-5	70-95	70-95	60-85	51-70	20-40	5-20
	12-30	Variable	GM, GC, SM, SC	A-2-4, A-4, A-6, A-2-6	5-50	30-80	25-75	20-60	13-50	20-40	5-20
Berda part	0-8	Loam	SC, CL, SM-SC, CL-ML	A-4, A-6	0-3	85-100	85-100	75-95	36-70	20-35	7-20
	8-58	Loam, clay loam, sandy clay loam.	SC, CL, SM-SC, CL-ML	A-4, A-6	0	85-100	85-100	75-95	40-75	20-35	7-20
[1]40:											
Potter part	0-12	Loam	CL, ML, CL-ML	A-4, A-6	0-5	70-95	70-95	60-85	51-70	20-40	5-20
	12-30	Variable	GM, GC, SM, SC	A-2-4, A-4, A-6, A-2-6	5-50	30-80	25-75	20-60	13-50	20-40	5-20
Kimbrough part	0-11	Loam	SM, ML, CL-ML	A-4	0-10	80-90	75-85	65-80	45-65	20-30	NP-10
	11-14	Indurated	---	---	---	---	---	---	---	---	---
	14-34	Variable	---	---	---	---	---	---	---	---	---
Urban land part.											
Pullman:											
41	0-12	Clay loam	CL	A-6, A-7-6	0	100	100	95-100	70-90	30-50	15-30
	12-46	Clay, silty clay	CL, CH	A-7-6	0	100	100	95-100	85-98	41-55	22-35
	46-80	Clay loam, clay, silty clay.	CL	A-6, A-7-6	0	95-100	90-100	80-100	75-95	30-50	15-30
Randall:											
42	0-62	Clay	CL, CH	A-7-6	0	100	100	95-100	75-98	41-70	22-45
Randall Variant:											
43	0-20	Fine sandy loam	SM-SC, CL-ML, SC, CL	A-4	0	100	100	95-100	36-65	20-28	4-10
	20-80	Clay, silty clay	CL, CH	A-7-6	0	100	100	95-100	75-98	41-70	22-45
Urban land:											
44.											
Zita:											
45	0-12	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	100	100	95-100	35-50	17-25	2-7
	12-36	Clay loam	CL	A-6, A-7-6	0	98-100	98-100	95-100	60-75	30-42	12-25
	36-66	Clay loam	CL	A-6, A-7-6	0	90-100	80-98	80-98	50-75	30-42	12-25
46	0-12	Loam	CL, CL-ML	A-4, A-6	0	100	100	98-100	51-70	24-32	7-15
	12-36	Clay loam	CL	A-6, A-7-6	0	98-100	98-100	95-100	60-75	30-42	12-25
	36-66	Clay loam	CL	A-6, A-7-6	0	90-100	80-98	80-98	50-75	30-42	12-25

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
Acuff:										
1, 2	0-12	0.6-2.0	0.12-0.18	6.6-7.8	Low	Moderate	Low	0.28	5	5
	12-38	0.6-2.0	0.14-0.19	7.4-8.4	Low	Moderate	Low	0.32		
	38-80	0.6-2.0	0.10-0.16	7.9-8.4	Low	Moderate	Low	0.32		
[1]3:										
Acuff part	0-12	0.6-2.0	0.12-0.18	6.6-7.8	Low	Moderate	Low	0.28	5	5
	12-38	0.6-2.0	0.14-0.19	7.4-8.4	Low	Moderate	Low	0.32		
	38-80	0.6-2.0	0.10-0.16	7.9-8.4	Low	Moderate	Low	0.32		
Urban land part.										
Amarillo:										
4	0-14	2.0-6.0	0.06-0.10	6.6-7.8	Very low	Low	Low	0.15	5	2
	14-46	0.6-2.0	0.14-0.18	7.4-8.4	Low	Moderate	Low	0.32		
	46-80	0.6-2.0	0.10-0.15	7.9-8.4	Low	Moderate	Low	0.32		
5, 6	0-14	2.0-6.0	0.11-0.15	6.6-7.8	Low	Low	Low	0.24	5	3
	14-46	0.6-2.0	0.14-0.18	7.4-8.4	Low	Moderate	Low	0.32		
	46-80	0.6-2.0	0.10-0.15	7.9-8.4	Low	Moderate	Low	0.32		
[1]7:										
Amarillo part	0-14	2.0-6.0	0.11-0.15	6.6-7.8	Low	Low	Low	0.24	5	3
	14-46	0.6-2.0	0.14-0.18	7.4-8.4	Low	Moderate	Low	0.32		
	46-80	0.6-2.0	0.10-0.15	7.9-8.4	Low	Moderate	Low	0.32		
Urban land part.										
Arch:										
8	0-9	0.6-2.0	0.15-0.17	7.9-8.4	Low	High	Low	0.28	5	4L
	9-17	0.6-2.0	0.16-0.19	7.9-8.4	Moderate	High	Low	0.37		
	17-62	0.6-2.0	0.15-0.17	7.9-9.0	Moderate	High	Low	0.37		
Arents:										
[1]9:										
Arents part	0-80	---	---	---	---	---	---	---	---	---
Pits part.										
Berda:										
10, 11	0-8	0.6-2.0	0.14-0.18	7.9-8.4	Low	Moderate	Low	0.28	5	5
	8-58	0.6-2.0	0.14-0.18	7.9-8.4	Low	Moderate	Low	0.32		
[1]12:										
Berda part	0-8	0.6-2.0	0.14-0.18	7.9-8.4	Low	Moderate	Low	0.28	5	5
	8-58	0.6-2.0	0.14-0.18	7.9-8.4	Low	Moderate	Low	0.32		
Potter part	0-12	0.6-2.0	0.10-0.16	7.9-8.4	Low	Moderate	Low	0.28	1	---
	12-30	0.6-6.0	0.00-0.06	7.9-8.4	Low	Moderate	Low	---		
Bippus:										
13	0-8	2.0-6.0	0.11-0.15	7.4-8.4	Low	Moderate	Low	0.24	5	3
	8-72	0.6-2.0	0.14-0.20	7.9-8.4	Moderate	Moderate	Low	0.28		
14, 15	0-8	0.6-2.0	0.14-0.20	7.4-8.4	Moderate	Moderate	Low	0.28	5	6
	8-72	0.6-2.0	0.14-0.20	7.9-8.4	Moderate	Moderate	Low	0.28		
Drake:										
16, 17	0-60	0.6-2.0	0.10-0.17	7.9-8.4	Low	High	Low	0.28	5	4L
Estacado:										
18, 19	0-16	0.6-2.0	0.14-0.19	7.9-8.4	Low	Moderate	Low	0.28	5	4L
	16-26	0.6-2.0	0.12-0.18	7.9-8.4	Low	Moderate	Low	0.32		
	26-66	0.6-2.0	0.10-0.18	7.9-8.4	Low	Moderate	Low	0.32		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
Estacado:										
[1]20:										
Estacado part---	0-16	0.6-2.0	0.14-0.19	7.9-8.4	Low-------	Moderate	Low------	0.28	5	4L
	16-26	0.6-2.0	0.12-0.18	7.9-8.4	Low-------	Moderate	Low------	0.32		
	28-66	0.6-2.0	0.10-0.18	7.9-8.4	Low-------	Moderate	Low------	0.32		
Urban land part.										
Friona:										
21----------	0-8	0.6-2.0	0.12-0.18	6.6-8.4	Low-------	Moderate	Low------	0.28	2	5
	8-26	0.6-2.0	0.14-0.19	7.4-8.4	Low-------	Moderate	Low------	0.32		
	26-32	---	---	---	----------	---------	---------	---		
	32-60	---	---	---	----------	---------	---------	---		
Kimbrough:										
22----------	0-11	0.6-2.0	0.13-0.17	7.4-8.4	Low-------	Moderate	Low------	0.32	1	4L
	11-14	---	---	---	----------	---------	---------	---		
	14-34	---	---	---	----------	---------	---------	---		
Lofton:										
23----------	0-10	0.2-.60	0.16-0.20	6.6-8.4	Moderate	High-----	Low------	0.32	5	6
	10-50	<.06	0.16-0.20	7.4-8.4	High------	High-----	Low------	0.32		
	50-72	.06-.20	0.12-0.16	7.9-8.4	Moderate	High-----	Low------	0.32		
Mansker:										
24, 25----------	0-8	0.6-2.0	0.13-0.19	7.9-8.4	Low-------	Moderate	Low------	0.28	3	4L
	8-32	0.6-2.0	0.08-0.16	7.9-8.4	Low-------	Moderate	Low------	0.28		
	32-60	0.6-2.0	0.10-0.18	7.9-8.4	Low-------	Moderate	Low------	0.28		
Midessa:										
26----------	0-7	2.0-6.0	0.10-0.15	7.9-8.4	Low-------	Moderate	Low------	0.24	3	3
	7-23	0.6-2.0	0.12-0.18	7.9-8.4	Low-------	Moderate	Low------	0.32		
	23-66	0.6-2.0	0.10-0.16	7.9-8.4	Low-------	Moderate	Low------	0.32		
Mobeetie:										
27, 28, 29--------	0-72	2.0-6.0	0.10-0.14	7.9-8.4	Low-------	Low------	Low------	0.24	3	3
Olton:										
30, 31----------	0-10	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	Moderate	Low------	0.32	5	6
	10-42	0.2-0.6	0.14-0.19	7.4-8.4	Moderate	Moderate	Low------	0.37		
	42-80	0.2-0.6	0.10-0.16	7.9-8.4	Moderate	Moderate	Low------	0.37		
[1]32:										
Olton part------	0-10	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	Moderate	Low------	0.32	5	6
	10-42	0.2-0.6	0.14-0.19	7.4-8.4	Moderate	Moderate	Low------	0.37		
	42-80	0.2-0.6	0.10-0.16	7.9-8.4	Moderate	Moderate	Low------	0.37		
Urban land part.										
Portales:										
33----------	0-14	0.6-2.0	0.15-0.18	7.4-8.4	Low-------	High-----	Low------	0.32	3	4L
	14-80	0.6-2.0	0.13-0.17	7.4-8.4	Moderate	High-----	Low------	0.32		
Posey:										
34, 35, 36, 37----	0-10	2.0-6.0	0.10-0.15	7.9-8.4	Low-------	Moderate	Low------	0.24	3	3
	10-39	0.6-2.0	0.10-0.16	7.9-8.4	Low-------	Moderate	Low------	0.32		
	39-80	0.6-2.0	0.10-0.18	7.9-8.4	Low-------	Moderate	Low------	0.32		
Potter:										
38----------	0-12	0.6-2.0	0.10-0.16	7.9-8.4	Low-------	Moderate	Low------	0.28	1	---
	12-30	0.6-6.0	0.00-0.06	7.9-8.4	Low-------	Moderate	Low------	---		
[1]39:										
Potter part-----	0-12	0.6-2.0	0.10-0.16	7.9-8.4	Low-------	Moderate	Low------	0.28	1	---
	12-30	0.6-6.0	0.00-0.06	7.9-8.4	Low-------	Moderate	Low------	---		
Berda part------	0-8	0.6-2.0	0.14-0.18	7.9-8.4	Low-------	Moderate	Low------	0.28	5	5
	8-58	0.6-2.0	0.14-0.18	7.9-8.4	Low-------	Moderate	Low------	0.32		
[1]40:										
Potter part-----	0-12	0.6-2.0	0.10-0.16	7.9-8.4	Low-------	Moderate	Low------	0.28	1	---
	12-30	0.6-6.0	0.00-0.06	7.9-8.4	Low-------	Moderate	Low------	---		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
Potter:										
Kimbrough part--	0-11	0.6-2.0	0.13-0.17	7.4-8.4	Low	Moderate	Low	0.32	1	4L
	11-14	---	---	---	---	---	---	---		
	14-34	---	---	---	---	---	---	---		
Urban land part.										
Pullman:										
41	0-12	0.2-0.6	0.14-0.19	6.6-8.4	Moderate	High	Low	0.32	5	6
	12-46	<0.06	0.12-0.17	7.4-8.4	High	High	Low	0.37		
	46-80	0.06-0.2	0.10-0.16	7.9-8.4	Moderate	High	Low	0.37		
Randall:										
42	0-62	<0.06	0.12-0.18	7.4-8.4	Very high	High	Low	0.32	5	4
Randall Variant:										
43	0-20	0.6-2.0	0.10-0.15	7.4-8.4	Low	Low	Low	0.24	5	3
	20-80	<0.06	0.12-0.18	7.4-8.4	High	High	Low	0.32		
Urban land:										
44.										
Zita:										
45	0-12	0.6-2.0	0.10-0.15	7.9-8.4	Low	Low	Low	0.24	4	3
	12-36	0.6-2.0	0.15-0.20	7.9-8.4	Low	Moderate	Low	0.32		
	36-66	0.6-2.0	0.10-0.16	7.9-8.4	Low	Moderate	Low	0.32		
46	0-12	0.6-2.0	0.15-0.20	7.9-8.4	Low	Low	Low	0.28	4	5
	12-36	0.6-2.0	0.15-0.20	7.9-8.4	Low	Moderate	Low	0.32		
	36-66	0.6-2.0	0.10-0.16	7.9-8.4	Low	Moderate	Low	0.32		

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 15.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and such terms as "rare," "brief," and "perched." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Depth	Hardness
					Ft			In		In	
Acuff: 1, 2	B	None	---	---	>6.0	---	---	>60	---	---	---
[1]3: Acuff part	B	None	---	---	>6.0	---	---	>60	---	---	---
Urban land part.											
Amarillo: 4, 5, 6	B	None	---	---	>6.0	---	---	>60	---	---	---
[1]7: Amarillo part	B	None	---	---	>6.0	---	---	>60	---	---	---
Urban land part.											
Arch: 8	B	None	---	---	>6.0	---	---	>60	---	---	---
Arents: [1]9: Arents part	B	None	---	---	>6.0	---	---	>60	---	---	---
Pits part.											
Berda: 10, 11	B	None	---	---	>6.0	---	---	>60	---	---	---
[1]12: Berda part	B	None	---	---	>6.0	---	---	>60	---	---	---
Potter part	C	None	---	---	>6.0	---	---	>60	---	---	---
Bippus: 13, 14, 15	B	None to common.	Very brief	Apr-Oct	>6.0	---	---	>60	---	---	---
Drake: 16, 17	B	None	---	---	>6.0	---	---	>60	---	---	---
Estacado: 18, 19	B	None	---	---	>6.0	---	---	>60	---	---	---
[1]20: Estacado part	B	None	---	---	>6.0	---	---	>60	---	---	---
Urban land part.											
Friona: 21	C	None	---	---	>6.0	---	---	>60	---	20-40	Rippable
Kimbrough: 22	D	None	---	---	>6.0	---	---	>60	---	4-20	Hard
Lofton: 23	D	None	---	---	>6.0	---	---	>60	---	---	---
Mansker: 24, 25	B	None	---	---	>6.0	---	---	>60	---	---	---
Midessa: 26	B	None	---	---	>6.0	---	---	>60	---	---	---

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Depth	Hardness
					Ft			In		In	
Mobeetie: 27, 28, 29	B	None	---	---	>6.0	---	---	>60	---	---	---
Olton: 30, 31	C	None	---	---	>6.0	---	---	>60	---	---	---
[1]32: Olton part	C	None	---	---	>6.0	---	---	>60	---	---	---
Urban land part.											
Portales: 33	B	None	---	---	>6.0	---	---	>60	---	---	---
Posey: 34, 35, 36, 37	B	None	---	---	>6.0	---	---	>60	---	---	---
Potter: 38	C	None	---	---	>6.0	---	---	>60	---	---	---
[1]39: Potter part	C	None	---	---	>6.0	---	---	>60	---	---	---
Berda part	B	None	---	---	>6.0	---	---	>60	---	---	---
[1]40: Potter part	C	None	---	---	>6.0	---	---	>60	---	---	---
Kimbrough part-	D	None	---	---	>6.0	---	---	>60	---	4-20	Hard
Urban land part.											
Pullman: 41	D	None	---	---	>6.0	---	---	>60	---	---	---
Randall: 42	D	Common	Long to very long.	May-Nov	>6.0	---	---	>60	---	---	---
Randall Variant: 43	D	Common	Brief to long.	May-Nov	>6.0	---	---	>60	---	---	---
Urban land: 44.											
Zita: 45, 46	B	None	---	---	>6.0	---	---	>60	---	---	---

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 16.--POTENTIAL FOR URBANIZATION

Soil name and map symbol	Elements of urbanization				Potential for urbanization
	Dwellings	Streets	Excavations	Uncoated steel pipe	
Acuff: 1, 2, 3	High	High	Very high	High	High.
Amarillo: 4, 5, 6, 7	Very high	High	Very high	High	High.
Arch: 8	High	Medium	Very high	Low	Medium.
Berda: 10, 11, [1]12, [1]39	Very high	Very high	Very high	High	High.
Bippus: 13, 14, 15	Very low	Very low	Very low	High	Very low.
Drake: 16, 17	Very high	High	Medium	Low	Medium.
Estacado: 18, 19, 20	High	High	Very high	High	High.
Friona: 21	Medium	High	High	Medium	Medium.
Kimbrough: 22, [1]40	Low	Low	Low	Low	Low.
Lofton: 23	Low	Low	Low	Low	Low.
Mansker: 24, 25	Medium	Medium	Medium	High	Medium.
Midessa: 26	High	Medium	High	High	High.
Mobeetie: 27, 28, 29	High	High	High	Very high	High.
Olton: 30, 31, 32	Medium	Low	Medium	High	Medium.
Portales: 33	Medium	High	High	Low	Medium.
Posey: 34, 35, 36, 37	High	High	High	High	High.
Potter: [1]12, 38, [1]39, [1]40	Low	Medium	Medium	High	Medium.
Pullman: 41	Low	Low	Low	Very low	Low.
Randall: 42, 43	Very low	Very low	Very low	Very low	Very low.
Zita: 45, 46	High	High	High	High	High.

[1]This map unit is made up of two or more dominant kinds of soils. See map unit description for the composition and behavior of the whole map unit.

TABLE 17.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Acuff	Fine-loamy, mixed, thermic Aridic Paleustolls
Amarillo	Fine-loamy, mixed, thermic Aridic Paleustalfs
*Arch	Fine-loamy, mixed, thermic Ustochreptic Calciorthids
Arents	Arents
Berda	Fine-loamy, mixed, thermic Aridic Ustochrepts
*Bippus	Fine-loamy, mixed, thermic Cumulic Haplustolls
Drake	Fine-loamy, mixed (calcareous), thermic Typic Ustorthents
Estacado	Fine-loamy, mixed, thermic Calciorthidic Paleustolls
Friona	Fine-loamy, mixed, thermic Petrocalcic Paleustolls
Kimbrough	Loamy, mixed, thermic, shallow Petrocalcic Calciustolls
Lofton	Fine, mixed, thermic Vertic Argiustolls
Mansker	Fine-loamy, carbonatic, thermic Calciorthidic Paleustolls
Midessa	Fine-loamy, mixed, thermic Aridic Ustochrepts
Mobeetie	Coarse-loamy, mixed, thermic Aridic Ustochrepts
Olton	Fine, mixed, thermic Aridic Paleustolls
Portales	Fine-loamy, mixed, thermic Aridic Calciustolls
Posey	Fine-loamy, mixed, thermic Calciorthidic Paleustalfs
Potter	Loamy, carbonatic, thermic, shallow Ustollic Calciorthids
Pullman	Fine, mixed, thermic Torrertic Paleustolls
Randall	Fine, montmorillonitic, thermic Udic Pellusterts
Randall Variant	Coarse-loamy over clayey, mixed, thermic Aquic Ustifluvents
*Zita	Fine-loamy, mixed, thermic Aridic Haplustolls

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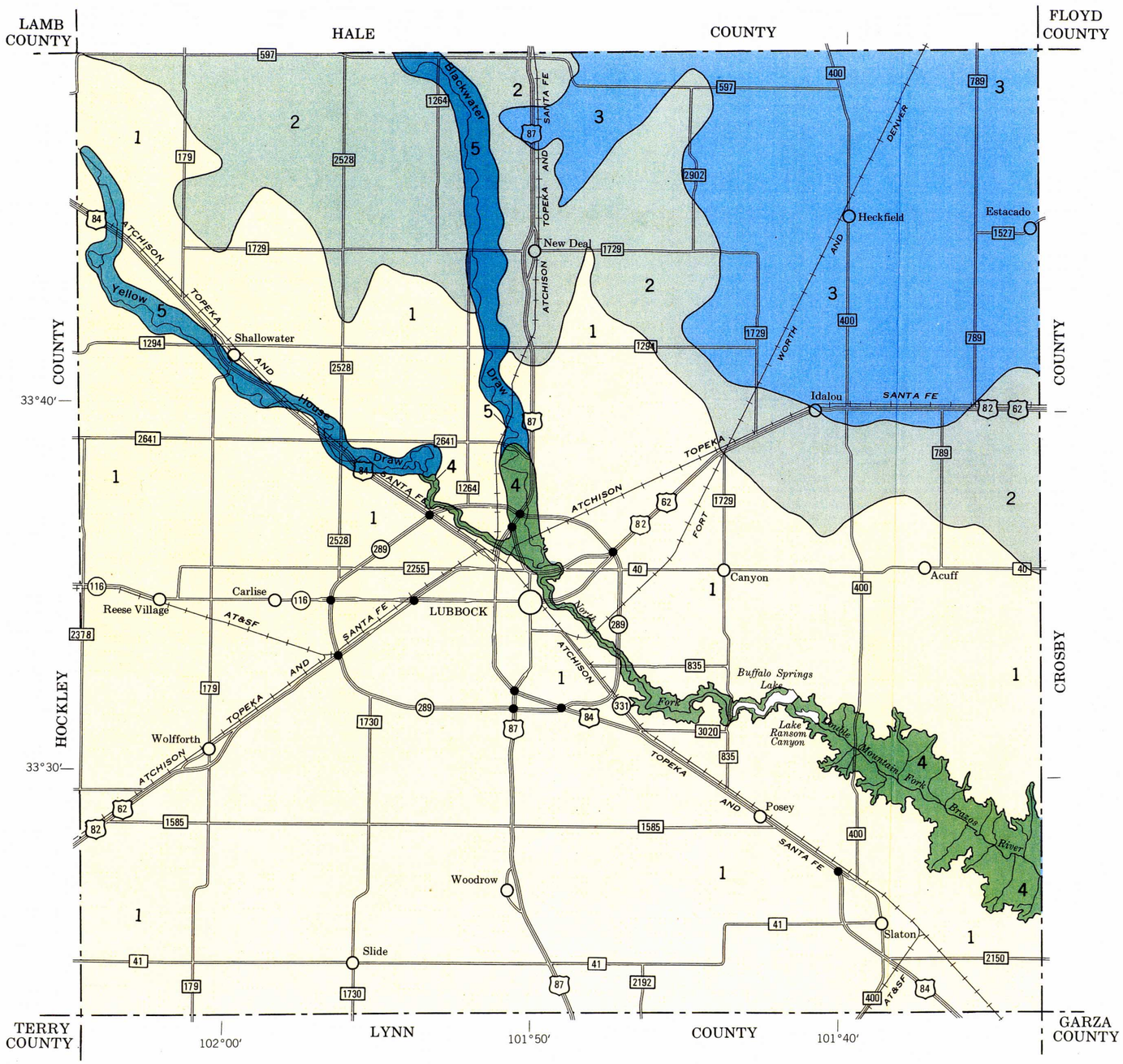


LEGEND*

1	AMARILLO-ACUFF: Deep, nearly level to gently sloping, moderately permeable loamy soils on uplands
2	OLTON-ACUFF: Deep, nearly level to gently sloping, moderately slowly permeable and moderately permeable loamy soils on uplands
3	PULLMAN-OLTON: Deep, nearly level to gently sloping, very slowly permeable and moderately slowly permeable loamy soils on uplands
4	POTTER-BERDA-BIPPUS: Very shallow, shallow, and deep, nearly level to steep, moderately permeable loamy soils on uplands and bottom lands
5	POSEY-MANSKER-BIPPUS: Deep, nearly level to sloping, moderately permeable loamy soils on bottom lands and uplands

* Texture refers to the surface layer of the major soils

Compiled 1977

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

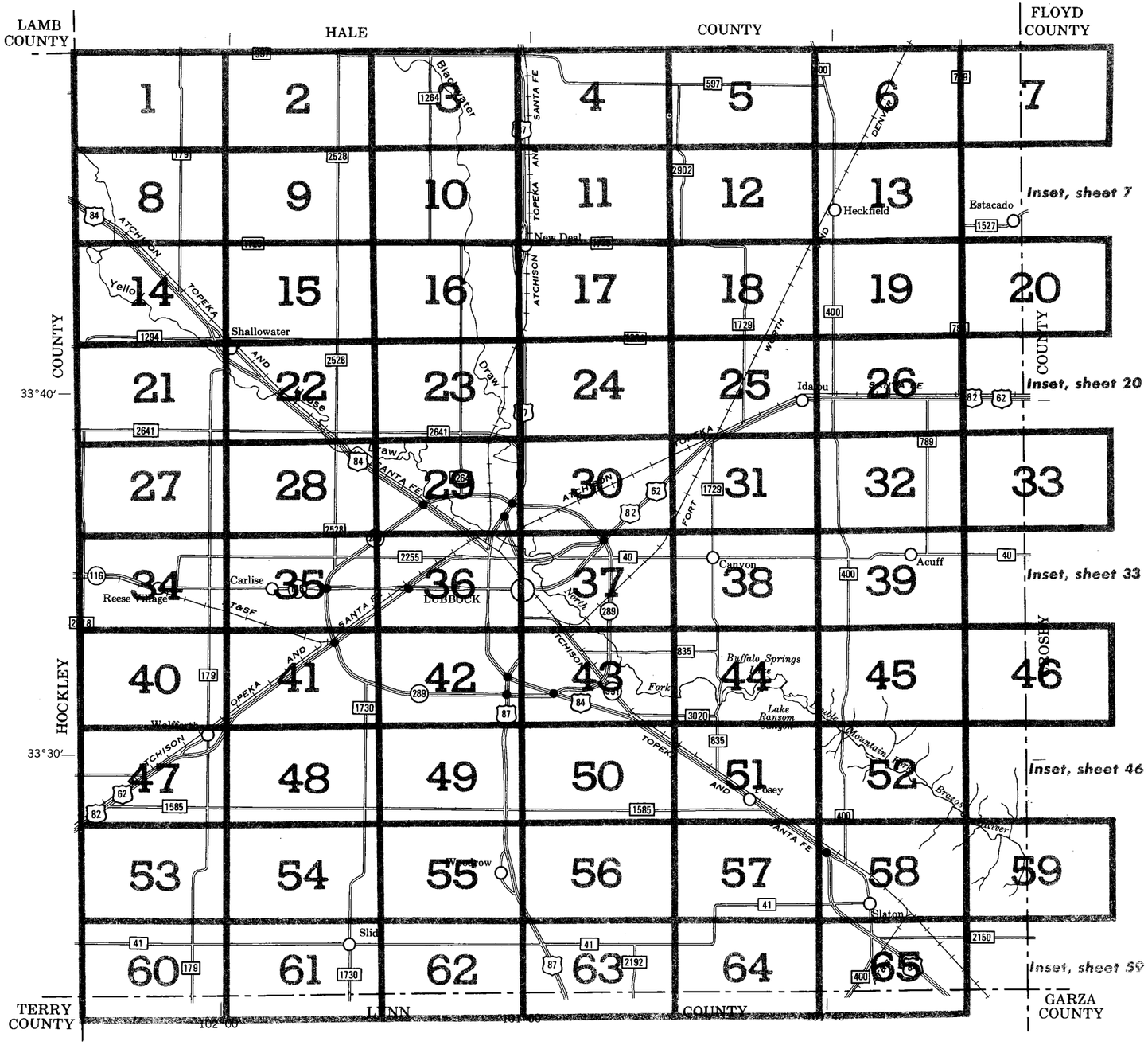
N

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
LUBBOCK COUNTY, TEXAS

Scale 1:190,080

1 0 1 2 3 4 Miles



N

INDEX TO MAP SHEETS
LUBBOCK COUNTY, TEXAS

Scale 1:190,080

1 0 1 2 3 4 Miles

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline
- AD HOC BOUNDARY (label)
- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)
- STATE COORDINATE TICK
- LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; w)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; w)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (CeA; FoB2)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

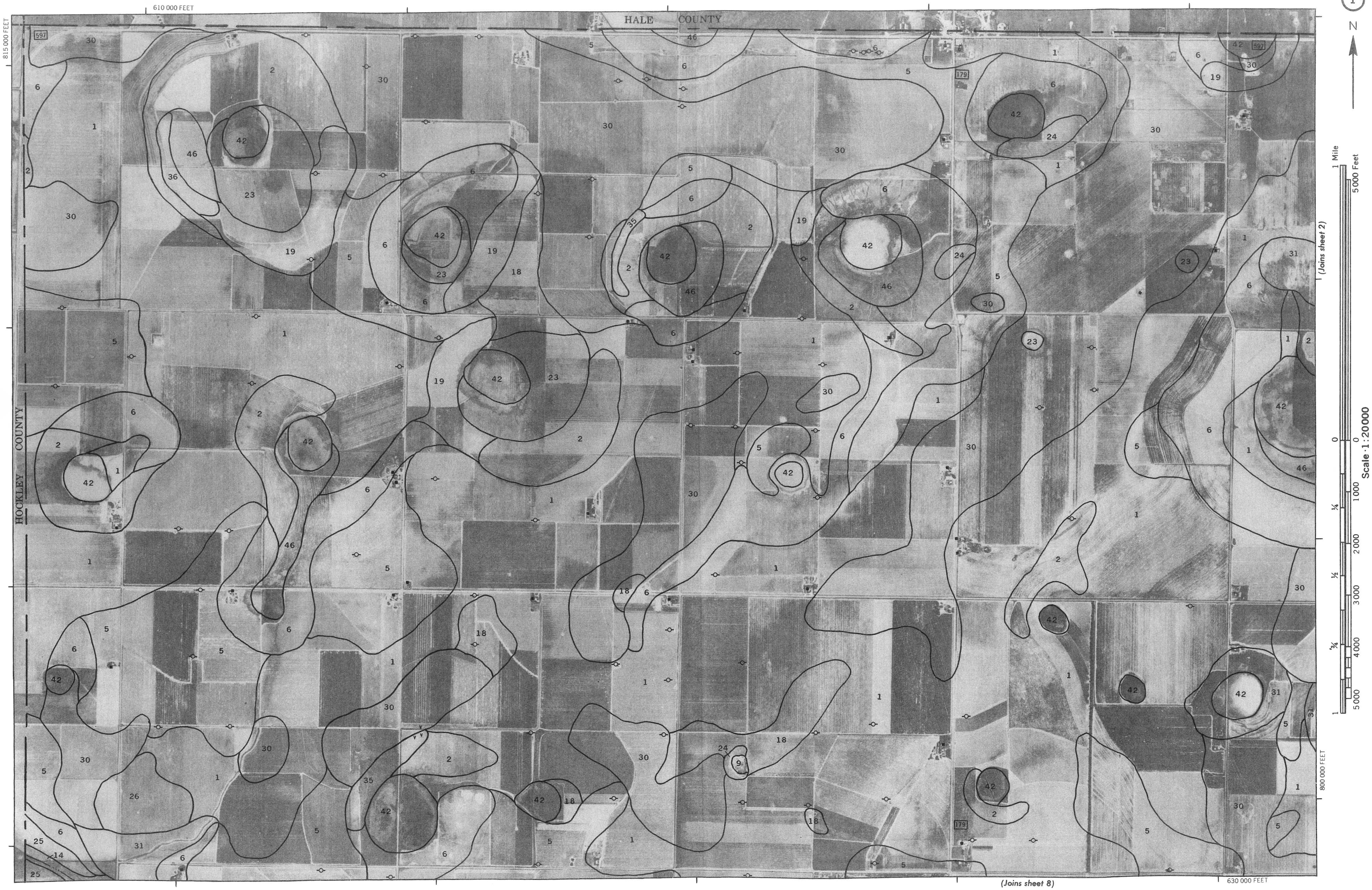
- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

SOIL LEGEND

Soil names followed by the superscript 1/ are broadly defined units. The composition of these units is more variable than that of the others in the survey area but has been controlled well enough to be interpreted for the expected use of the soils.

A (W) following the soil name indicates that signs of erosion, especially of local shifting of soil by wind, are evident in some places, but the degree of erosion cannot be reliably estimated.

SYMBOL	NAME
1	Acuff loam, 0 to 1 percent slopes
2	Acuff loam, 1 to 3 percent slopes
3	Acuff-Urban land complex, 0 to 2 percent slopes
4	Amarillo loamy fine sand, 0 to 3 percent slopes (W)
5	Amarillo fine sandy loam, 0 to 1 percent slopes (W)
6	Amarillo fine sandy loam, 1 to 3 percent slopes (W)
7	Amarillo-Urban land complex, 0 to 2 percent slopes
8	Arch loam, 0 to 3 percent slopes
9	Arents and Pits
10	Berda loam, 1 to 3 percent slopes
11	Berda loam, 3 to 5 percent slopes
12	Berda-Potter association, hilly 1/
13	Bippus fine sandy loam, frequently flooded
14	Bippus clay loam, occasionally flooded
15	Bippus clay loam, frequently flooded
16	Drake clay loam, 1 to 3 percent slopes (W)
17	Drake clay loam, 3 to 5 percent slopes (W)
18	Estacado clay loam, 0 to 1 percent slopes
19	Estacado clay loam, 1 to 3 percent slopes
20	Estacado-Urban land complex, 0 to 2 percent slopes
21	Friona loam, 0 to 1 percent slopes
22	Kimbrough loam, 0 to 3 percent slopes
23	Lofton clay loam, 0 to 1 percent slopes
24	Mansker clay loam, 1 to 3 percent slopes
25	Mansker clay loam, 3 to 5 percent slopes
26	Midessa fine sandy loam, 1 to 3 percent slopes (W)
27	Mobeetie fine sandy loam, 1 to 3 percent slopes (W)
28	Mobeetie fine sandy loam, 3 to 5 percent slopes (W)
29	Mobeetie fine sandy loam, 5 to 8 percent slopes (W)
30	Olton clay loam, 0 to 1 percent slopes
31	Olton clay loam, 1 to 3 percent slopes
32	Olton-Urban land complex, 0 to 2 percent slopes
33	Portales loam, 0 to 1 percent slopes
34	Posey fine sandy loam, 0 to 1 percent slopes (W)
35	Posey fine sandy loam, 1 to 3 percent slopes (W)
36	Posey fine sandy loam, 3 to 5 percent slopes (W)
37	Posey fine sandy loam, 5 to 8 percent slopes (W)
38	Potter loam, 2 to 12 percent slopes
39	Potter-Berda association, steep 1/
40	Potter-Kimbrough-Urban land complex, 1 to 5 percent slopes
41	Pullman clay loam, 0 to 1 percent slopes
42	Randall clay
43	Randall Variant fine sandy loam
44	Urban land
45	Zita fine sandy loam, 0 to 1 percent slopes (W)
46	Zita loam, 0 to 1 percent slopes



LUBBOCK COUNTY, TEXAS NO. 1

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LUBBOCK COUNTY, TEXAS — SHEET NUMBER 2

2

N

1 Mile 5000 Feet

Scale · 1:20000

HALE COUNTY

655 000 FEET

810 000 FEET

800 000 FEET

635 000 FEET

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 9)

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LUBBOCK COUNTY, TEXAS NO. 2

LUBBOCK COUNTY, TEXAS NO. 3

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660 000 FEET

810 000 FEET

HALE COUNTY

Abernathy

DAVIS FARM AIRFIELD (PVT)

Blackwater Draw

North Fork

Double Mountain Fork

Blackwater Draw

Brazos River

597

1264

(Joins sheet 2)

(Joins sheet 4)

(Joins sheet 10)

800 000 FEET

680 000 FEET

3

N

1 Mile

5000 Feet

0 0

Scale 1:20000

1 5000 ¾ 4000 ½ 3000 ¼ 2000 0 1000

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 4

4

N

Scale 1:20000

1 Mile 5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

705 000 FEET

810 000 FEET

800 000 FEET

685 000 FEET

HALE COUNTY

Abernathy

SANTA FE

TOPEKA

ATCHISON

AND

87 27 597

(Joins sheet 3)

(Joins sheet 5)

(Joins sheet 11)

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LUBBOCK COUNTY, TEXAS NO. 4

5

LUBBOCK COUNTY, TEXAS NO. 5

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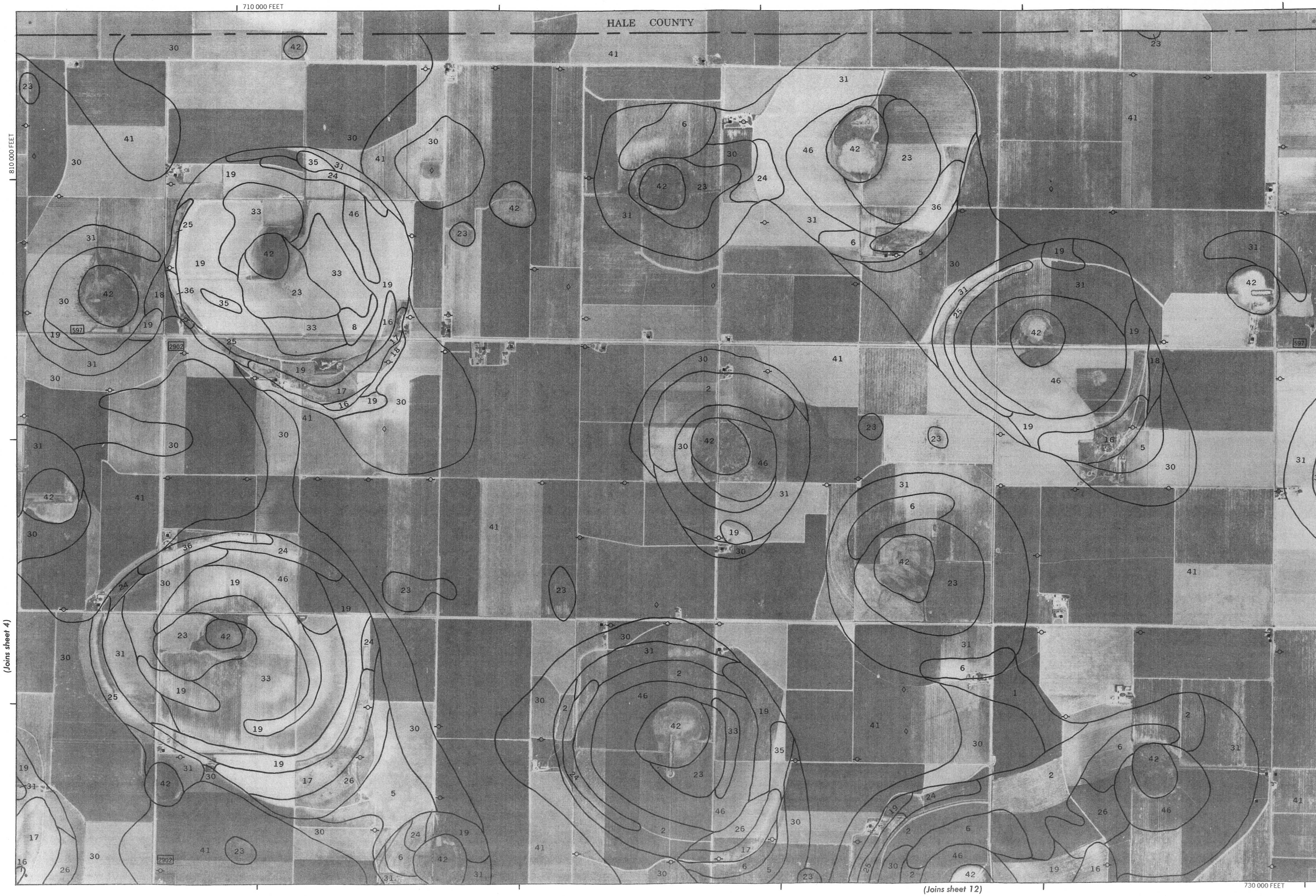


N

1 Mile
5000 Feet
0
0
1000
¼
2000
½
3000
¾
4000
1
5000
Scale 1:20000

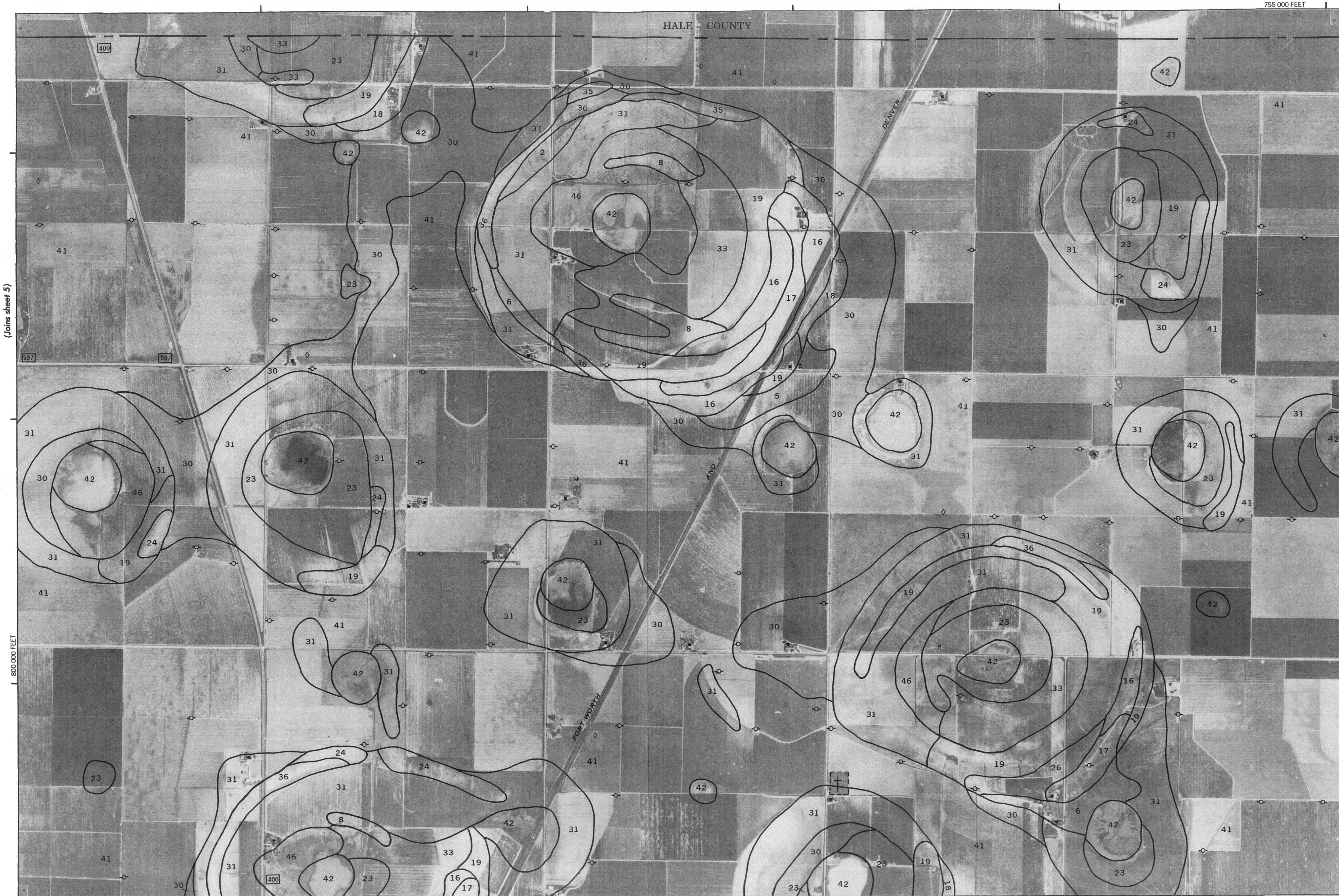
6

N

Scale 1:20000

1 Mile

5000 Feet



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LUBBOCK COUNTY, TEXAS NO. 6

LUBBOCK COUNTY, TEXAS NO. 7

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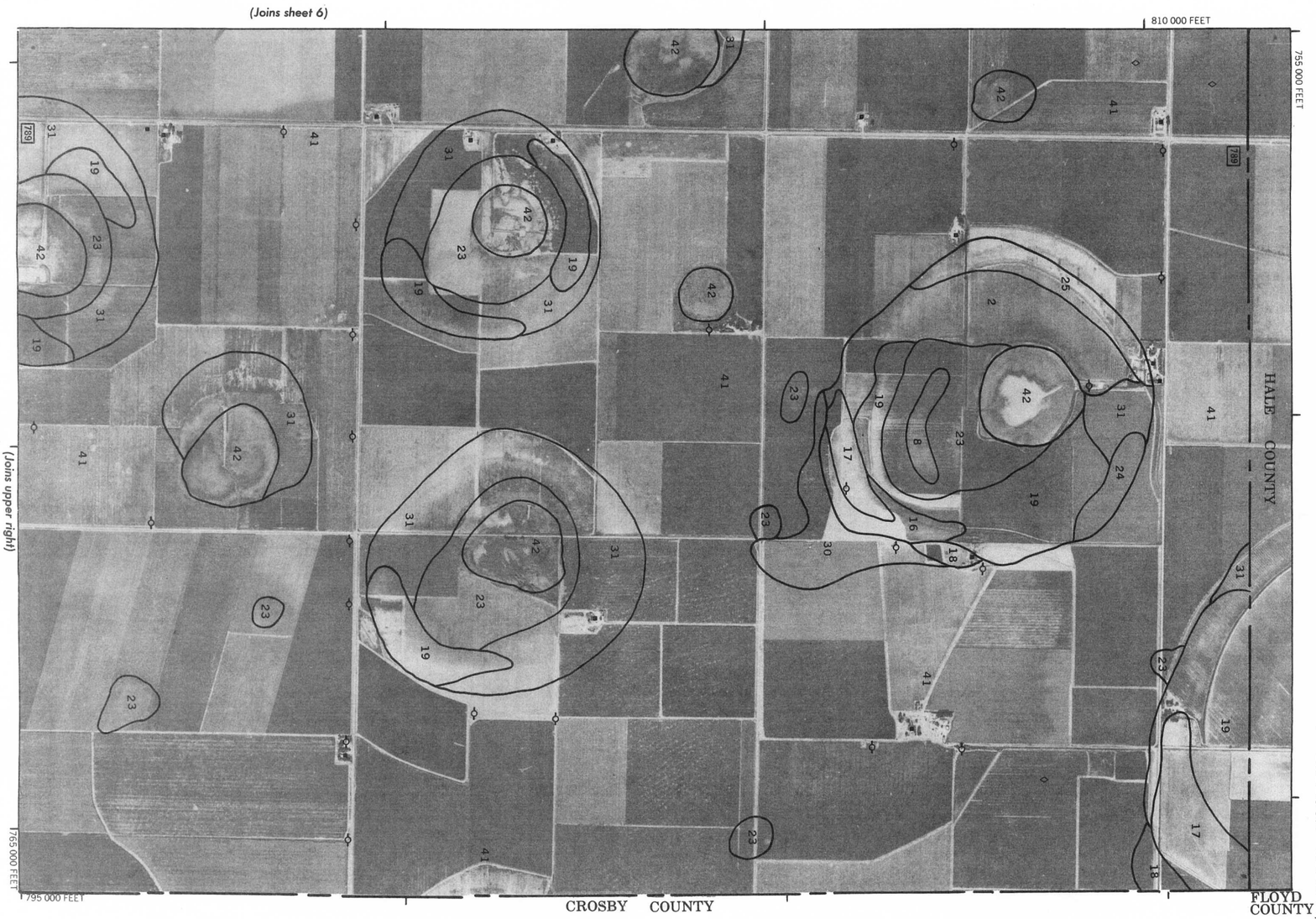
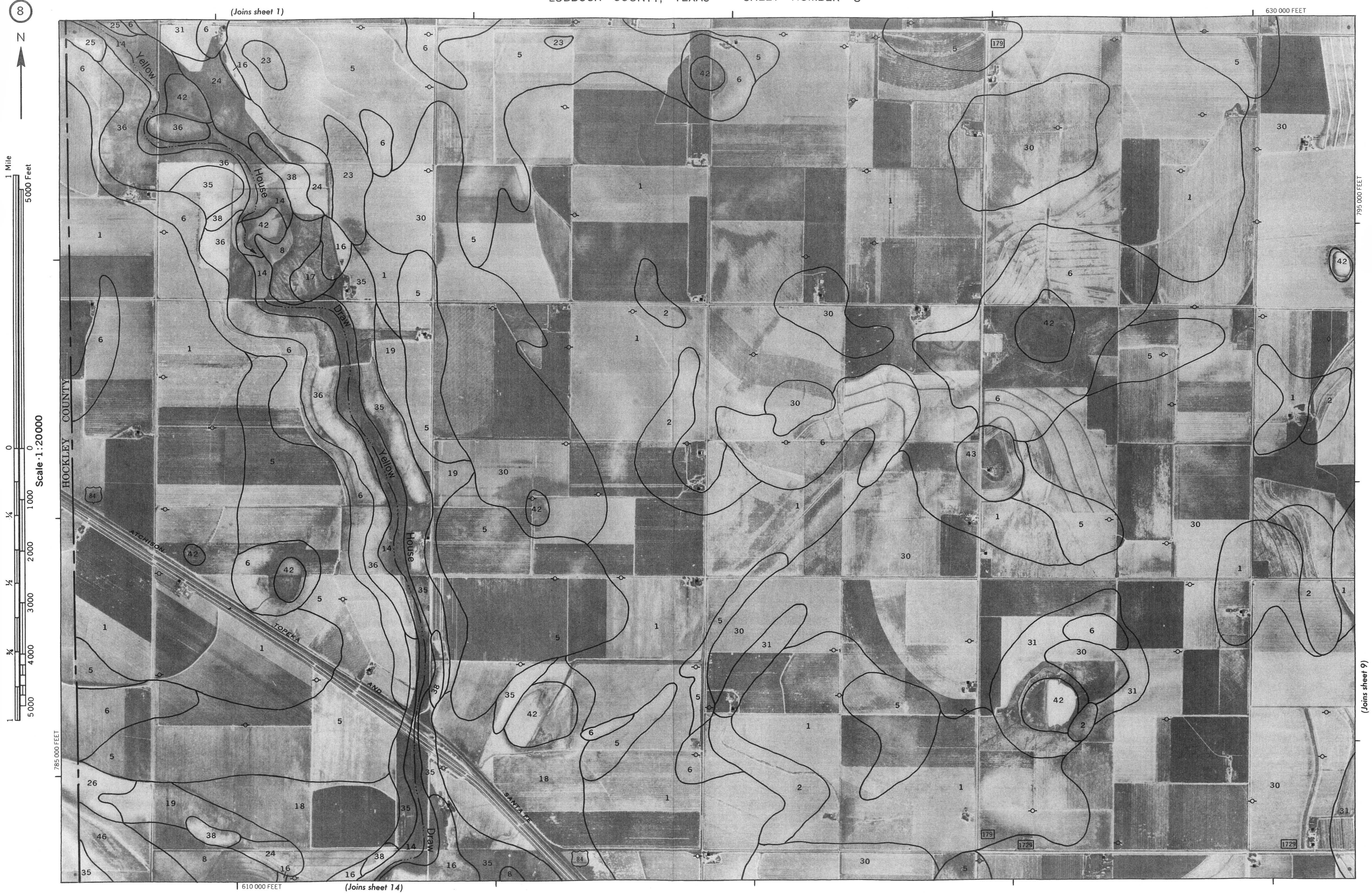


LUBBOCK COUNTY, TEXAS — SHEET NUMBER 7

1 ¾ ½ ¼ 0 1 Mile
5000 4000 3000 2000 1000 0 5000 Feet
Scale 1:20000

N

7



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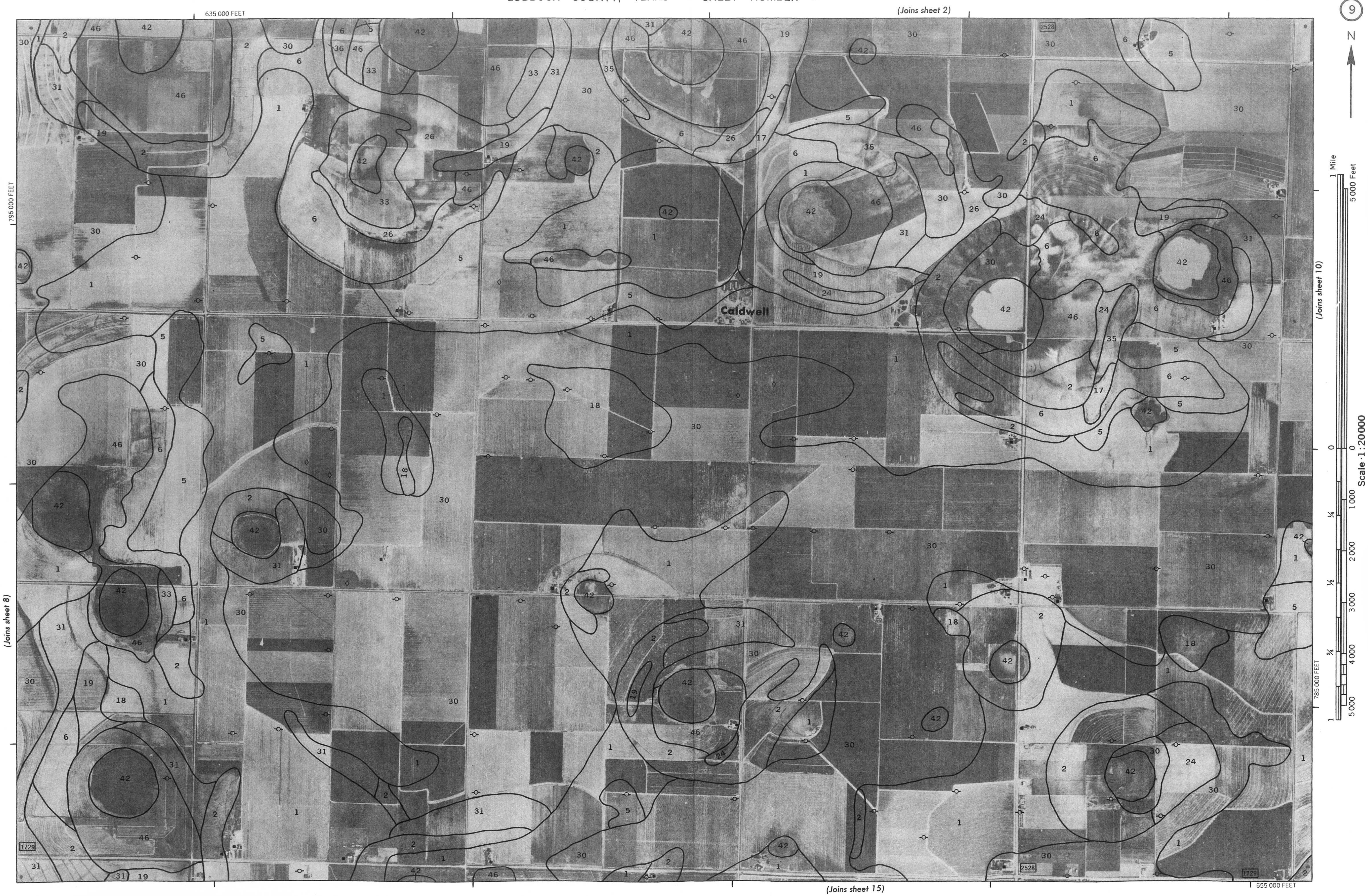
LUBBOCK COUNTY, TEXAS NO. 8



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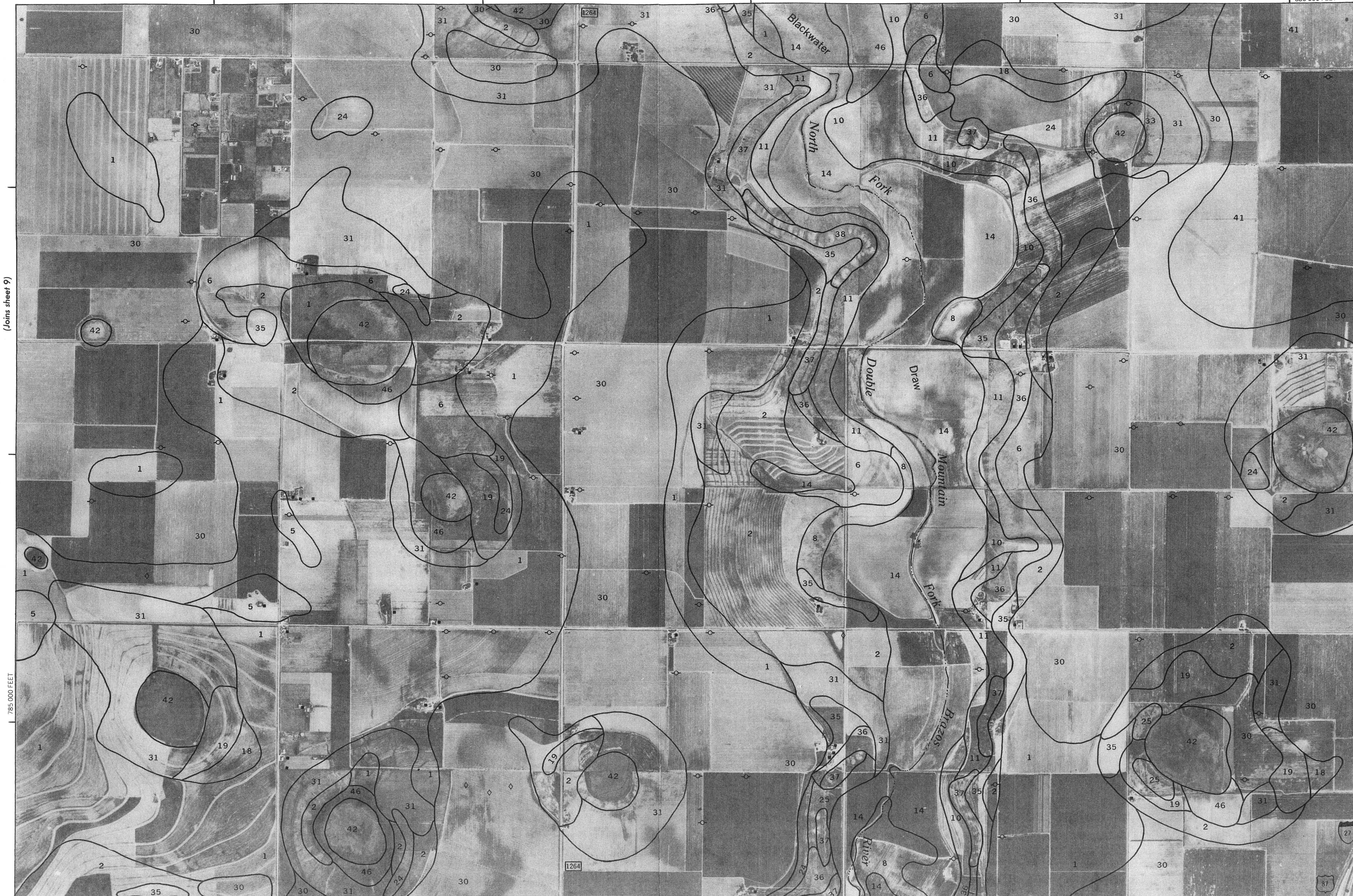
10

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 10

(Joins sheet 3)

680 000 FEET



(Joins sheet 9)

(Joins sheet 11)

795 000 FEET

785 000 FEET

660 000 FEET

(Joins sheet 16)

N

1 Mile

5000 Feet

Scale 1:20000

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LUBBOCK COUNTY, TEXAS NO. 10

LUBBOCK COUNTY, TEXAS NO. 11

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LUBBOCK COUNTY, TEXAS — SHEET NUMBER 12

12

N

(Joins sheet 5)

730 000 FEET

795 000 FEET

(Joins sheet 11)

785 000 FEET

705 000 FEET

(Joins sheet 18)

(Joins sheet 13)

1 Mile

5000 Feet

0 0

Scale · 1:20000

1 5 000 | ¾ 4000 | ½ 3000 | ¼ 2000 | 0 1000

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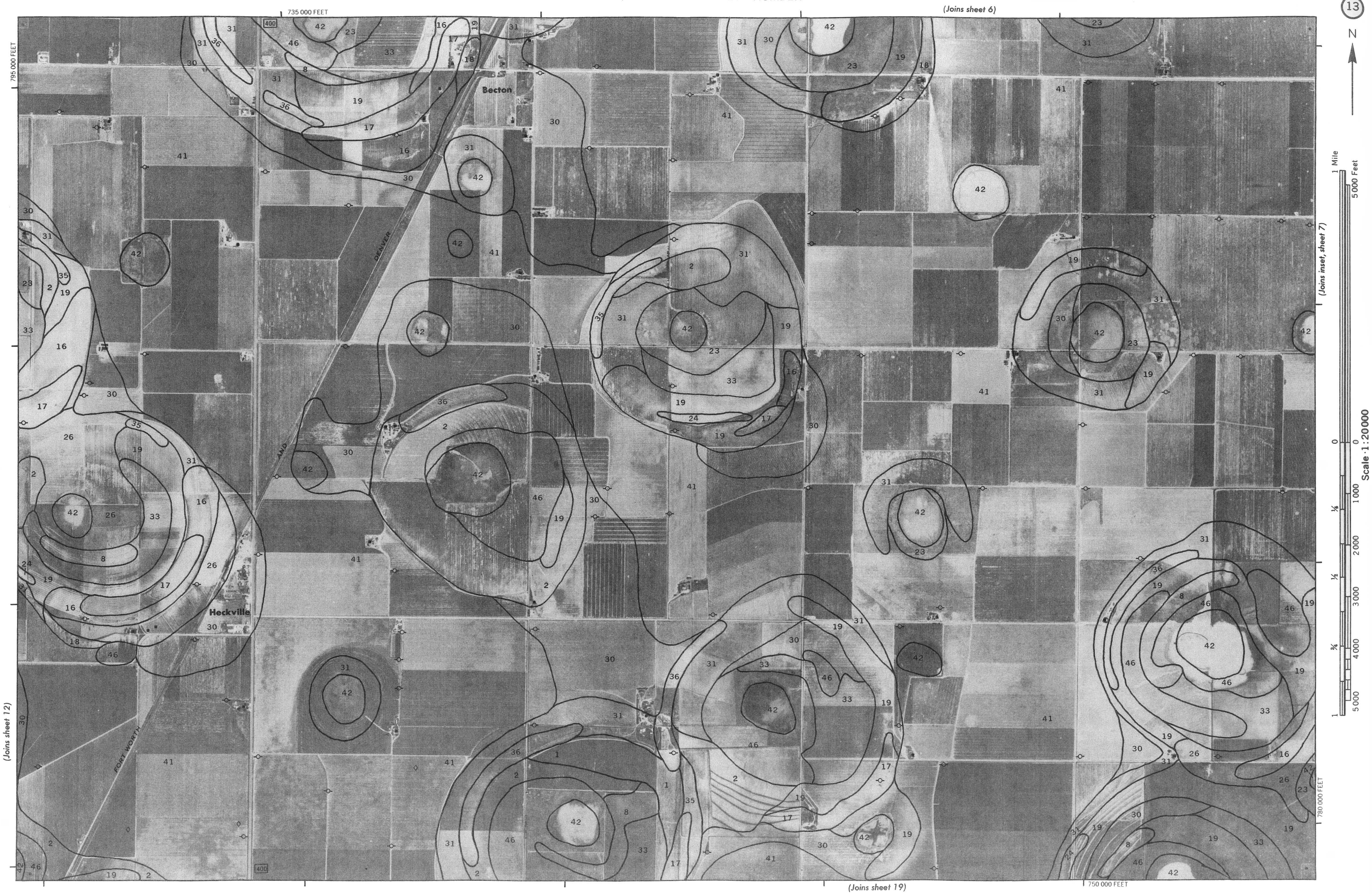
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 12

13



LUBBOCK COUNTY, TEXAS NO. 13

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 14

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 14

15

LUBBOCK COUNTY, TEXAS NO. 15

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 16

16

N

Scale 1:20000

1 Mile 0 5000 Feet

¼ 1000

½ 2000

¾ 3000

1 4000

5000

(Joins sheet 10)

(Joins sheet 15)

680 000 FEET

780 000 FEET

770 000 FEET

660 000 FEET

(Joins sheet 17)

(Joins sheet 23)

North Blackwater Fork

Double Draw

Montana Fork

Brazos River

New Deal

1729 1264 1294 27 87

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 16

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 17

LUBBOCK COUNTY, TEXAS NO. 17

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

685 000 FEET

780 000 FEET

(Joins sheet 11)

(Joins sheet 18)

(Joins sheet 16)

(Joins sheet 24)

765 000 FEET

700 000 FEET

New Deal

SANTA FE

TOPEKA

ATCHISON

AND

17

N

1 Mile

5000 Feet

Scale 1:20000

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 18

18

N

(Joins sheet 12)

725 000 FEET

780 000 FEET

(Joins sheet 17)

(Joins sheet 19)

765 000 FEET

705 000 FEET

(Joins sheet 25)

DENVER

FORT WORTH

1729

2902

1 Mile

5000 Feet

0 0

Scale · 1:20000

1/4 1000

1/2 2000 3000

3/4 4000

1 5000

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 18

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 19

19

N

730 000 FEET

780 000 FEET

(Joins sheet 13)

(Joins sheet 20)

(Joins sheet 18)

(Joins sheet 26)

765 000 FEET

750 000 FEET

1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

LUBBOCK COUNTY, TEXAS NO. 19

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 20

20

N

1 Mile
5000 Feet
Scale 1:20000
0 0
¼ 1000
½ 2000
¾ 3000
1 4000
5000

(Joins inset, sheet 7)

765 000 FEET

LORENZO AIRFIELD

CROSBY COUNTY

(Joins sheet 19)

765 000 FEET

755 000 FEET

(Joins upper right)

(Joins lower left)

760 000 FEET

(Joins sheet 26)

750 000 FEET

ATCHISON TOPEKA AND SANTA FE

755 000 FEET

(Joins sheet 33)

CROSBY COUNTY

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 20

LUBBOCK COUNTY, TEXAS NO. 21

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 22

22

N

(Joins sheet 15)

655 000 FEET

765 000 FEET

(Joins sheet 21)

1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

Shallowater

ATCHISON

Yellow

TOPEKA

House

ANO

SANTA FE

Draw

FT

84

2528

1294

2641

750 000 FEET

635 000 FEET

(Joins sheet 28)

(Joins sheet 23)

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 22

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 23

LUBBOCK COUNTY, TEXAS NO. 23

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

660 000 FEET

765 000 FEET

(Joins sheet 16)

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 29)

750 000 FEET

680 000 FEET

North Fork Blackwater Double Mountain Draw North Fork Brazos River SANTA FE T&P

23

N

1 Mile

5000 Feet

Scale 1:20000

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 24

24

N

(Joins sheet 17)

700 000 FEET

760 000 FEET

(Joins sheet 23)

(Joins sheet 25)

750 000 FEET

680 000 FEET

(Joins sheet 30)

LIBERTY

LUBBOCK MUNICIPAL AIRPORT

water

1 Mile

5000 Feet

Scale 1:20000

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 24

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 25

LUBBOCK COUNTY, TEXAS NO. 25

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinable grid ticks and land division corners, if shown, are approximately positioned.

705 000 FEET

760 000 FEET

750 000 FEET

725 000 FEET

(Joins sheet 18)

(Joins sheet 26)

(Joins sheet 24)

(Joins sheet 31)

DENVER

SANTA FE

TOPEKA AND SANTA FE

FORT WORTH AND DENVER

ATCHISON TOPEKA AND SANTA FE

IDALOU AIRFIELD (PVT)

Idalou

1294

1729

62 82

25

N

1 Mile

5 000 Feet

Scale 1:20000

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 26

26

N

(Joins sheet 19)

750 000 FEET

760 000 FEET

(Joins sheet 25)

DEBUSK AIRFIELD (PVT)

ATCHISON TOPEKA AND SANTA FE

Idalou

730 000 FEET

(Joins sheet 32)

(Joins inset, sheet 20)

1 Mile

5000 Feet

0 0

Scale 1:20000

1/4 1000

1/2 2000

3/4 3000

1 4000

5000

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 26

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 27

LUBBOCK COUNTY, TEXAS NO. 27

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

610 000 FEET

750 000 FEET

(Joins sheet 21)

(Joins sheet 28)

(Joins sheet 34)

630 000 FEET

735 000 FEET

HOCKLEY COUNTY

REESE AIRFORCE BASE

27

N

1 Mile

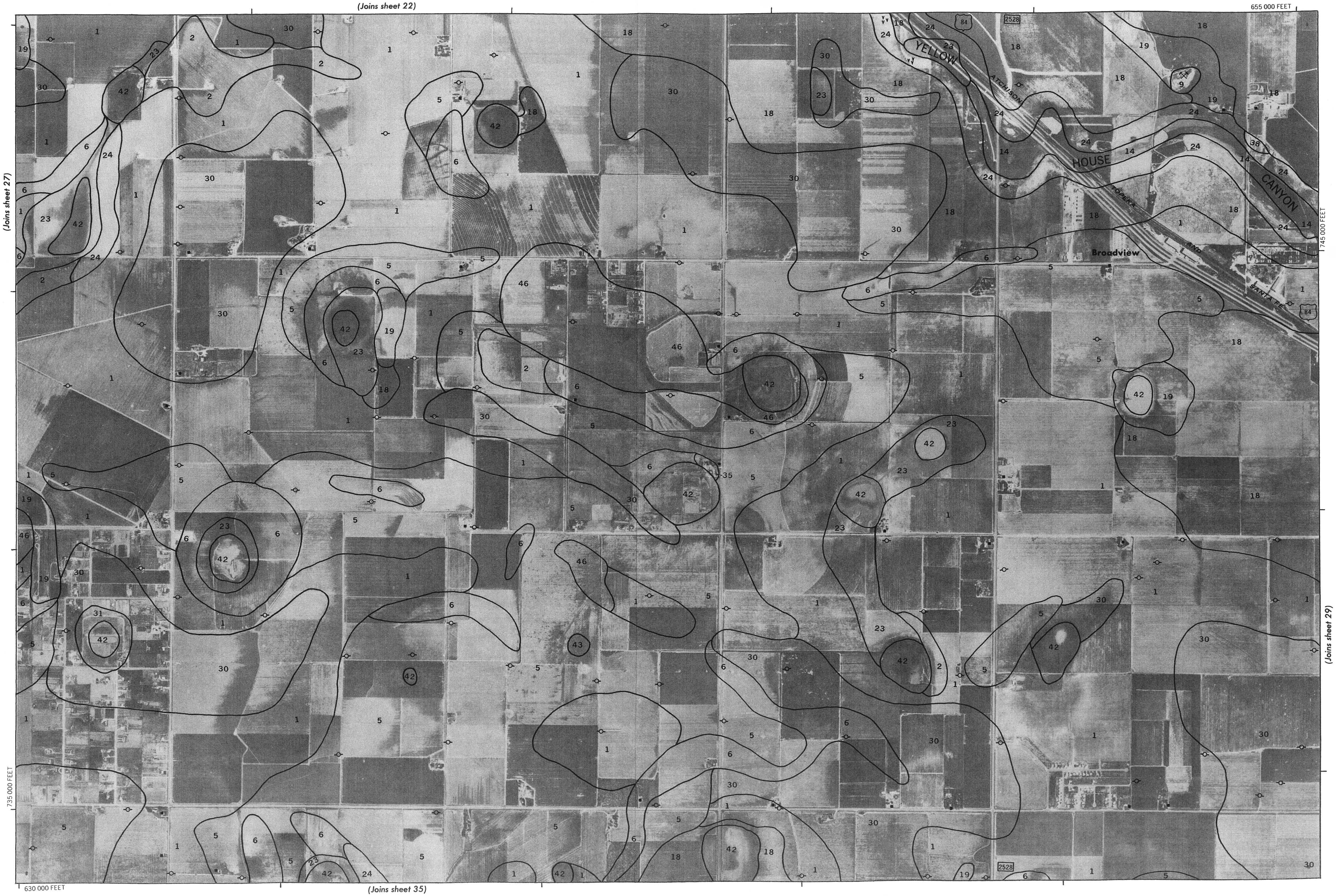
5000 Feet

Scale · 1 : 20000

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 28

N

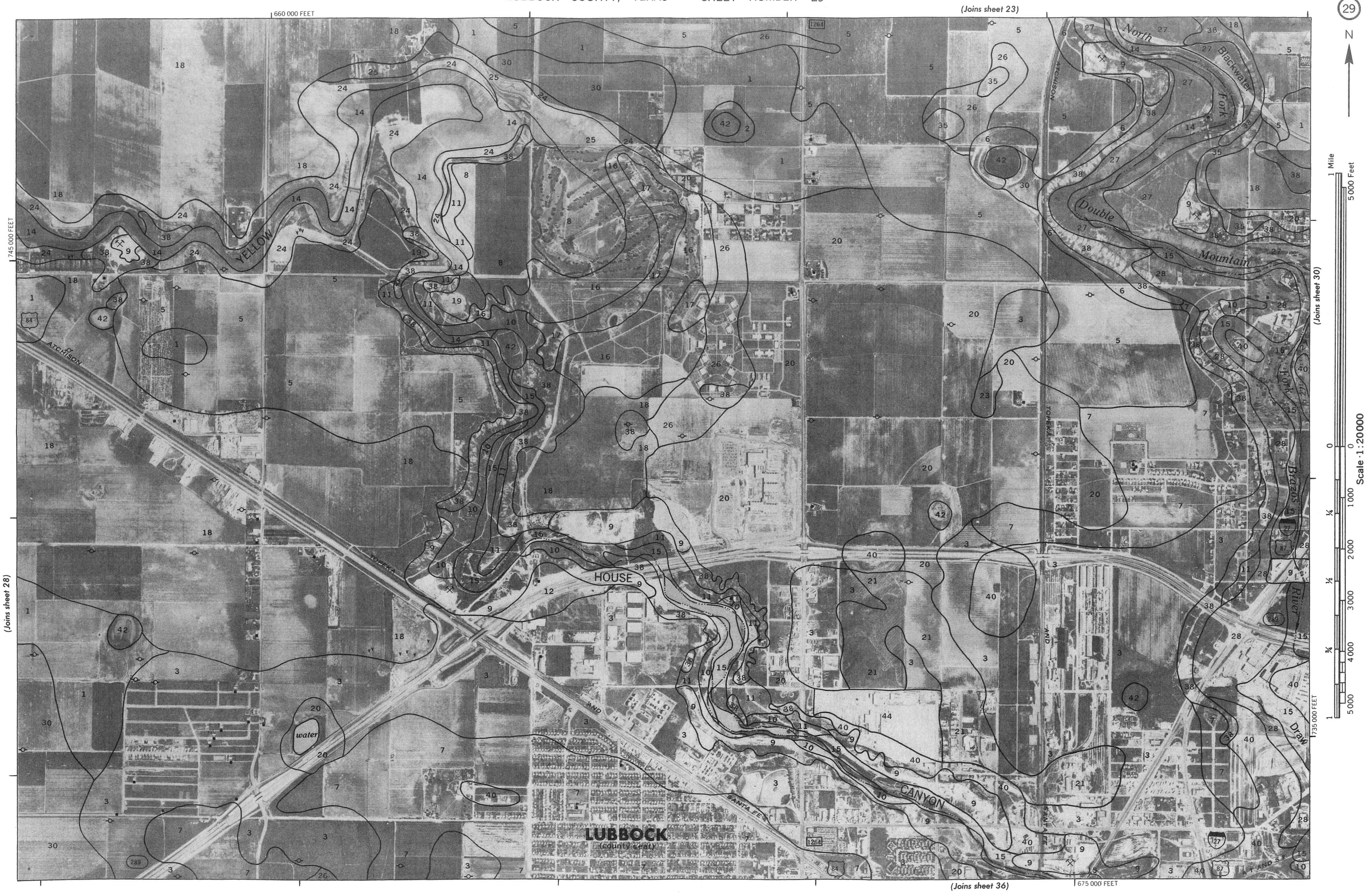
1 Mile
5 000 Feet
Scale 1:20000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000
0 5 000



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 28

29



LUBBOCK COUNTY, TEXAS NO. 29

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 30

30

N

1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

(Joins sheet 24)

(Joins sheet 29)

(Joins sheet 31)

(Joins sheet 37)

700 000 FEET

745 000 FEET

735 000 FEET

680 000 FEET

FORT WORTH AND DENVER

SANTA FE

TOPEKA AND

ATCHISON

LUBBOCK
(county seat)

North Fork Blackwater Draw

Double Mountain Fork Brazos River

289

62
82

This map is compiled on 1975 aerial photography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 30

LUBBOCK COUNTY, TEXAS NO. 31

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 32

32

N

(Joins sheet 26)

750 000 FEET

745 000 FEET

(Joins sheet 31)

735 000 FEET

730 000 FEET

(Joins sheet 39)

(Joins sheet 33)

1 Mile

5000 Feet

Scale 1:20000

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 32

LUBBOCK COUNTY, TEXAS NO. 33

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

755 000 FEET

745 000 FEET

(Joins inset, sheet 20)

(Joins sheet 32)

730 000 FEET

760 000 FEET

(Joins upper right)

CROSBY COUNTY

(Joins lower left)

730 000 FEET

(Joins sheet 39)

715 000 FEET

760 000 FEET

(Joins sheet 46)

CROSBY COUNTY

33

N

1 Mile

5000 Feet

Scale 1:20000

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 34

34

N

(Joins sheet 27)

630 000 FEET

730 000 FEET

720 000 FEET

605 000 FEET

(Joins sheet 40)

(Joins sheet 35)

REESE AIRFORCE BASE

ATCHISON TOPEKA AND SANTA FE

Hurlwood

water

HOCKLEY COUNTY

1 Mile

5000 Feet

0 0

Scale · 1:20000

¼ 1000

½ 2000

¾ 4000

1 5000

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 34

LUBBOCK COUNTY, TEXAS NO. 35

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

630 000 FEET

730 000 FEET

(Joins sheet 28)

(Joins sheet 36)

(Joins sheet 34)

(Joins sheet 41)

720 000 FEET

650 000 FEET

LUBBOCK
County Seat

Carlisle

ATCHISON, TOPEKA AND SANTA FE

35

N

1 Mile

5000 Feet

0 1 2 3 4 5 000

0 ¼ ½ ¾ 1 1000 2000 3000 4000 5000

Scale 1:20000

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 36

36

N

(Joins sheet 29)

675 000 FEET

730 000 FEET

(Joins sheet 35)

(Joins sheet 37)

720 000 FEET

655 000 FEET

(Joins sheet 42)

1 Mile

5000 Feet

0

0

Scale 1:20000

1/4 1/2 3/4 1

1000 2000 3000 4000 5000

water

Texas Tech University

LUBBOCK
(county seat)

YELLOW HOUSE CANYON

ATCHISON TOPEKA & SANTA FE

DENVER AND RIO GRANDE

FORT WORTH AND DENVER

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 36

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 37

LUBBOCK COUNTY, TEXAS NO. 37

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

680 000 FEET

730 000 FEET

(Joins sheet 30)

(Joins sheet 38)

(Joins sheet 36)

(Joins sheet 43)

720 000 FEET

700 000 FEET

LUBBOCK
(county seat)

North Fork

Yellow

Double Mountain Fork

Brazos

Canyon

Atchison, Topeka and Santa Fe

Fort Worth and Denver

Santa Fe

water

37

N

1 Mile

5000 Feet

Scale 1:20000

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 38

38

N

(Joins sheet 31)

725 000 FEET

730 000 FEET

(Joins sheet 37)

720 000 FEET

705 000 FEET

(Joins sheet 44)

(Joins sheet 39)

CANYON

Roosevelt

1 Mile

5000 Feet

0 0

Scale-1:20000

1/4 1/2 3/4

1000 2000 3000 4000 5000

1

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 38

LUBBOCK COUNTY, TEXAS NO. 39

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 40

(40)

N

1 Mile 5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

(Joins sheet 34)

625 000 FEET

715 000 FEET

705 000 FEET

605 000 FEET

(Joins sheet 41)

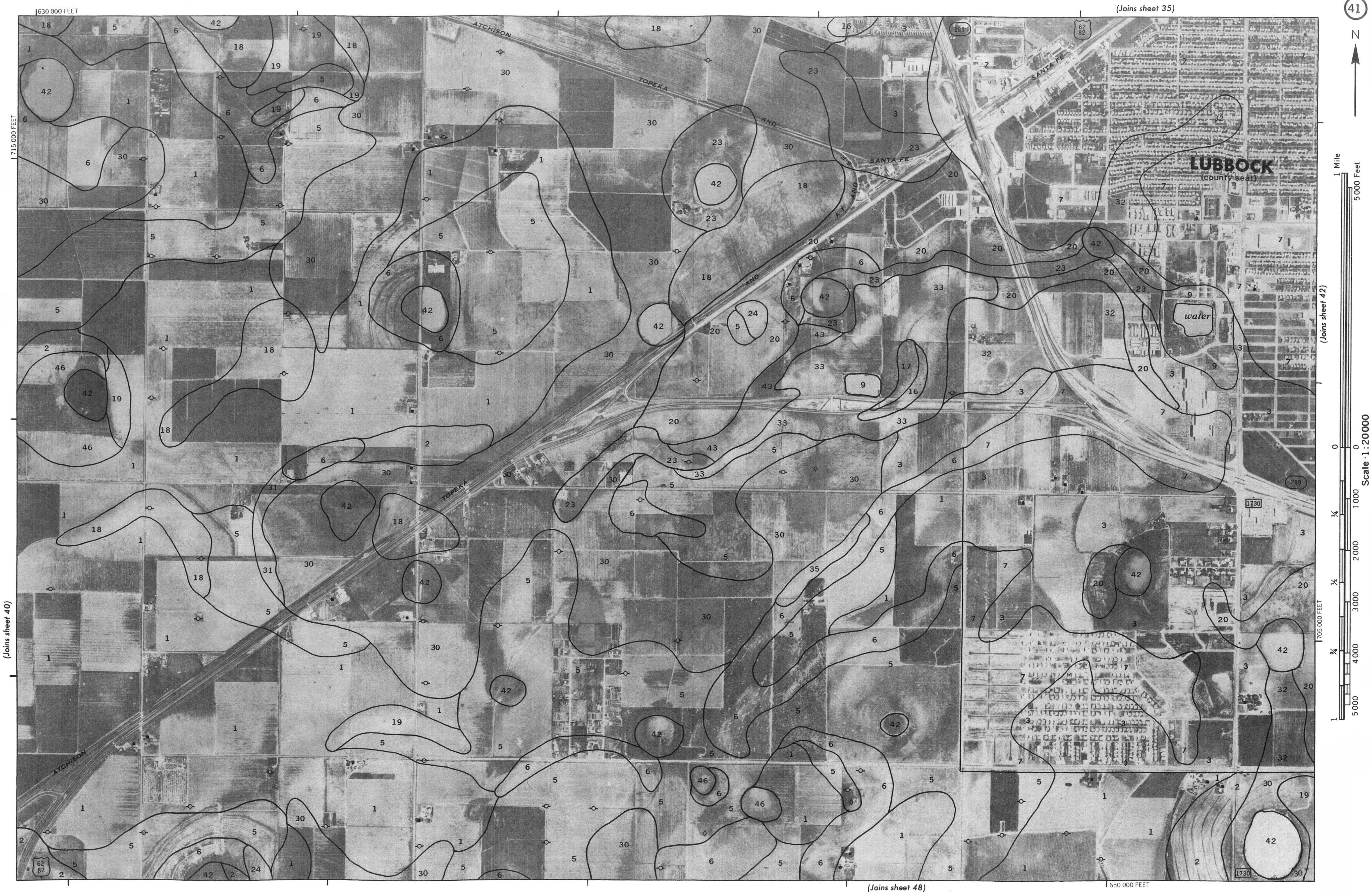
(Joins sheet 47)

HOCKLEY COUNTY

SPIKES FARM AIRFIELD (PVT)

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 40



LUBBOCK COUNTY, TEXAS NO. 41

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 42

42

N

(Joins sheet 36)

675 000 FEET

715 000 FEET

(Joins sheet 41)

LUBBOCK
(county seat)

water

705 000 FEET

(Joins sheet 43)

655 000 FEET

(Joins sheet 49)

1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 42

LUBBOCK COUNTY, TEXAS NO. 43

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 44

44

N

(Joins sheet 38)

725 000 FEET

715 000 FEET

(Joins sheet 43)

1 Mile

5000 Feet

Scale 1:20000

700 000 FEET

705 000 FEET

(Joins sheet 51)

(Joins sheet 45)

BUFFALO SPRINGS LAKE

HOUSE

YELLOW

Blake Lake

water

North

Benson Lake

Amiett Lake

Double Mountain Fork

Brazos River

JOHNSTON RANCH LAKE

CANYON

1729

835

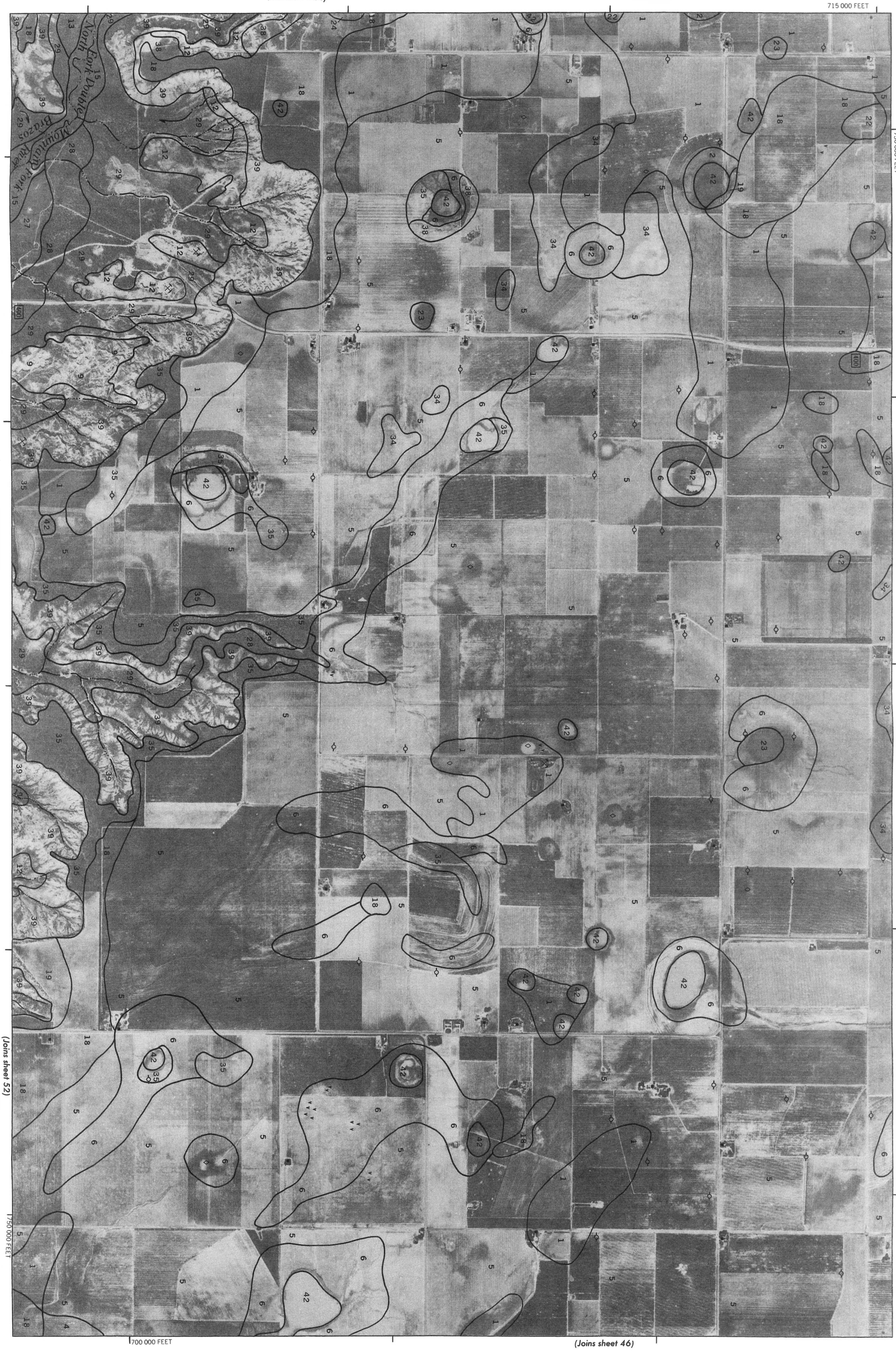
3020

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 44

LUBBOCK COUNTY, TEXAS NO. 45

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



LUBBOCK COUNTY, TEXAS — SHEET NUMBER 45

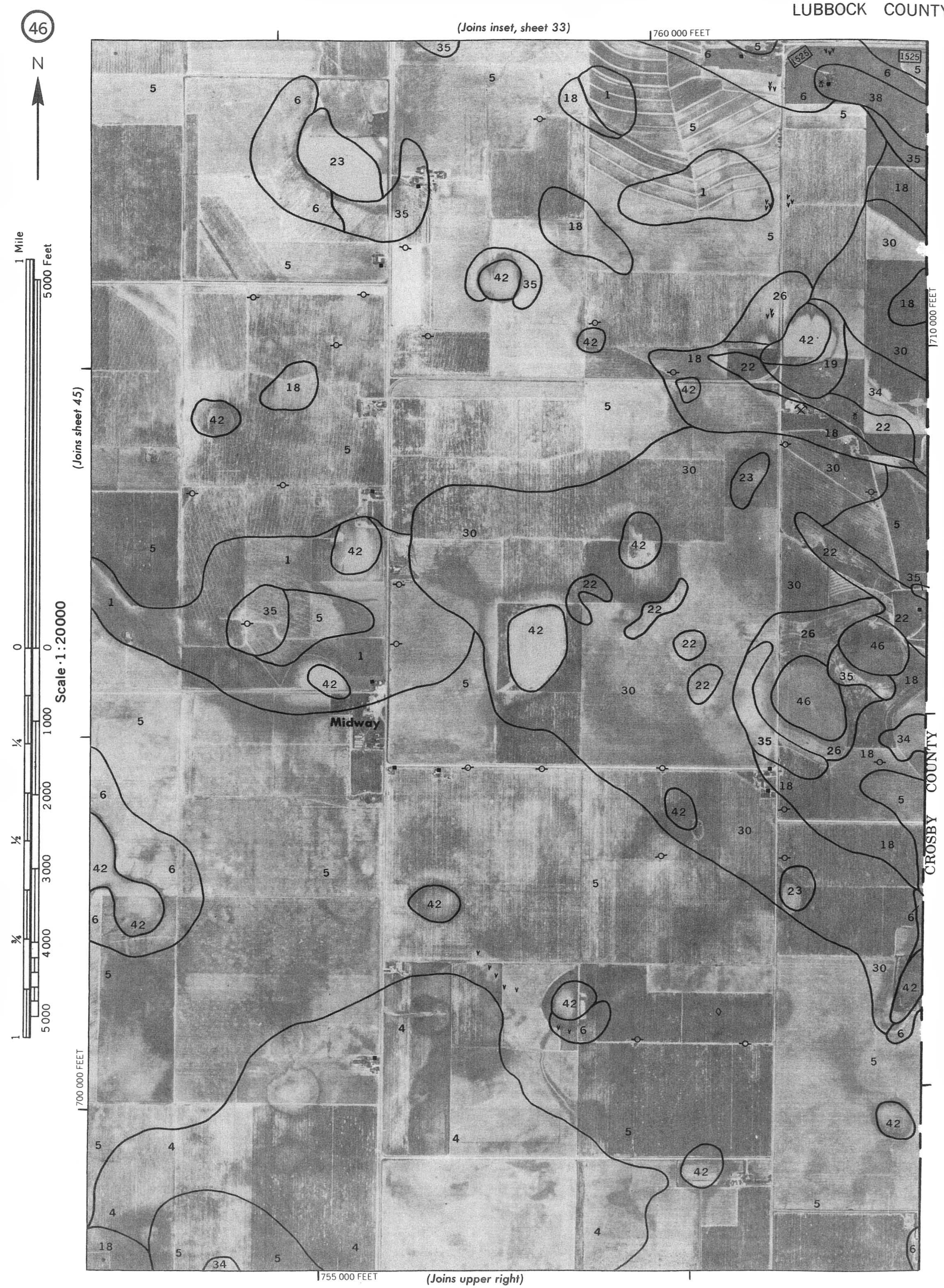
1 ¾ ½ ¼ 0 1 Mile

5 000 4 000 3 000 2 000 1 000 0 5 000 Feet

Scale · 1 : 20000

N

45



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 46

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 47

LUBBOCK COUNTY, TEXAS NO. 47

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

605 000 FEET

700 000 FEET

(Joins sheet 40)

(Joins sheet 48)

(Joins sheet 53)

685 000 FEET

625 000 FEET

Wolfforth

HOCKLEY COUNTY

SANTA FE

TOPEKA

AND

1585

179

82

47

N

1 Mile

5000 Feet

Scale 1:20000

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 48

48

N

(Joins sheet 41)

650 000 FEET

700 000 FEET

(Joins sheet 47)

(Joins sheet 49)

685 000 FEET

630 000 FEET

(Joins sheet 54)

1 Mile

5000 Feet

0 0

Scale 1:20000

¼ ½ ¾ 1

1 000 2 000 3 000 4 000 5 000

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 48

(Joins sheet 42)

655 000 FEET

700 000 FEET

(Joins sheet 48)

(Joins sheet 50)

(Joins sheet 55)

675 000 FEET

685 000 FEET

49

N

1 Mile

5000 Feet

Scale 1:20000

LUBBOCK COUNTY, TEXAS NO. 49

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 50

50

N

(Joins sheet 43)

700 000 FEET

695 000 FEET

685 000 FEET

680 000 FEET

(Joins sheet 49)

(Joins sheet 51)

(Joins sheet 56)

ATCHISON TOPEKA AND SANTA FE

TOWN AND COUNTRY AIRFIELD

1585

1 Mile

5000 Feet

Scale 1:20000

0 0 1000 2000 3000 4000 5000

¼ ½ ¾ 1

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 50

LUBBOCK COUNTY, TEXAS NO. 51

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 52

52

N

(Joins sheet 45)

750 000 FEET

695 000 FEET

(Joins sheet 51)

685 000 FEET

730 000 FEET

(Joins sheet 58)

(Joins inset, sheet 46)

North Fork YELLOW

Double Mountain Fork

HOUSE

Brazos River

CANYON

SLATON AIRFIELD

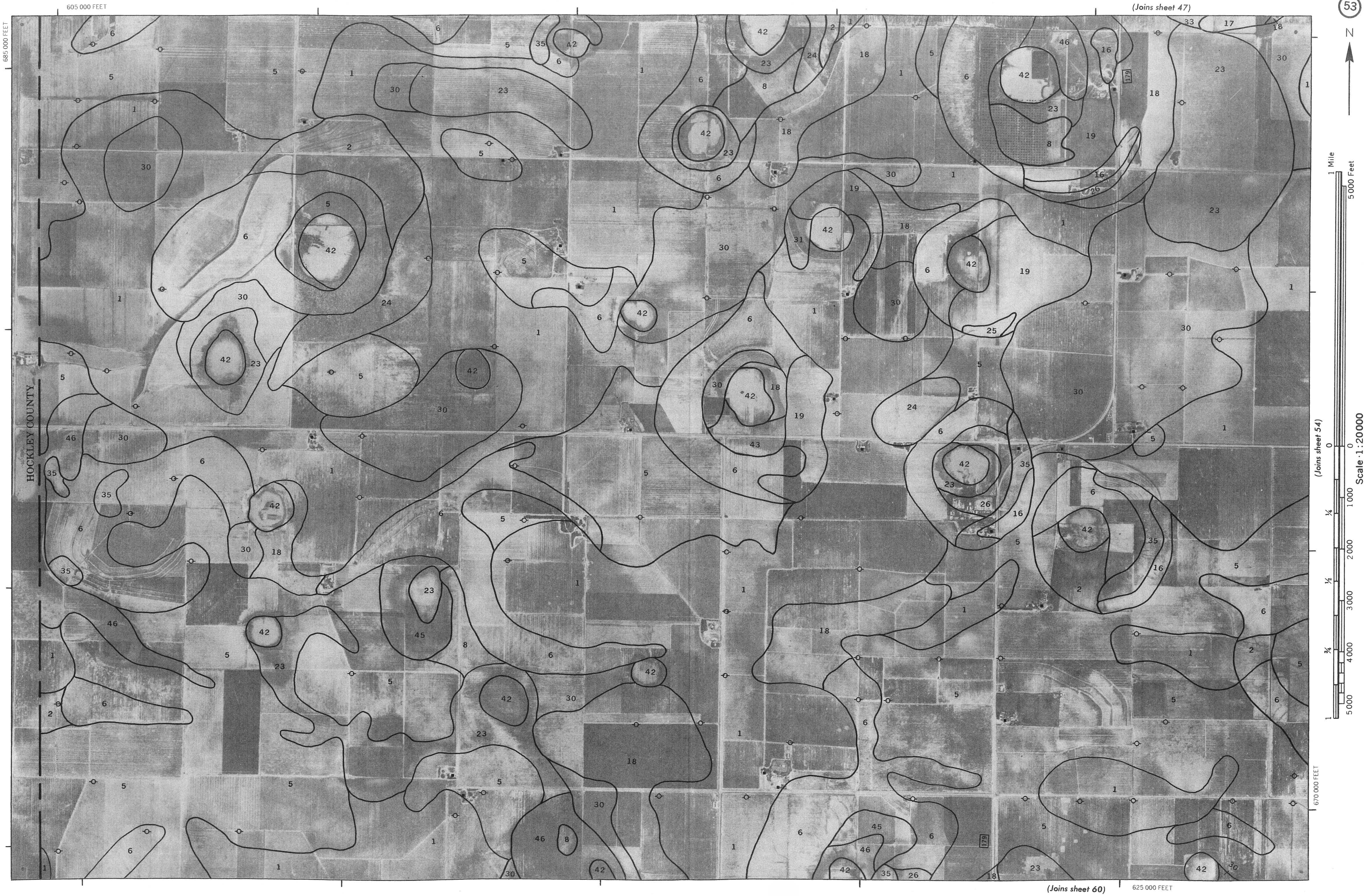
1 Mile

5000 Feet

Scale 1:20000

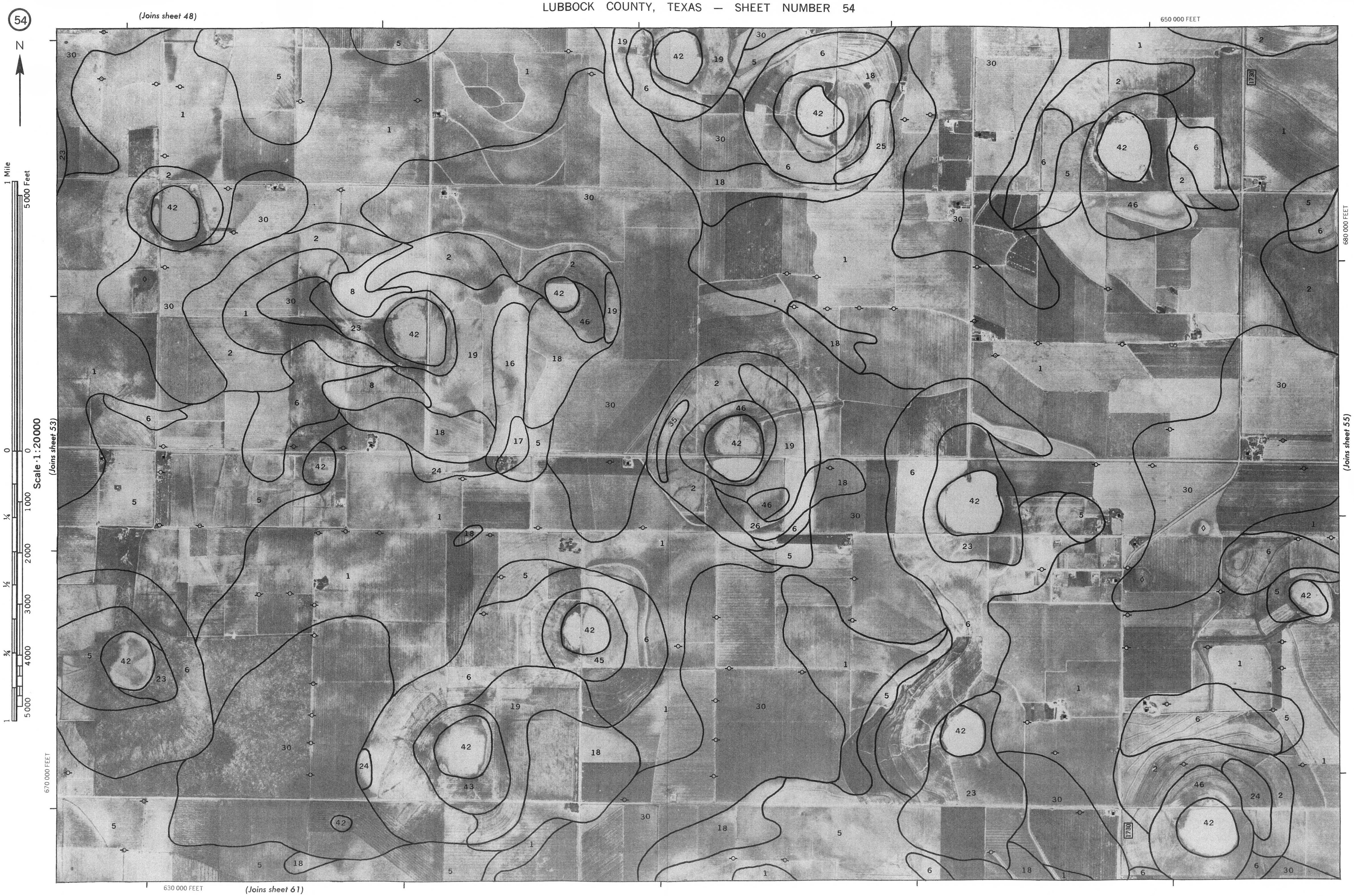
This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 52



LUBBOCK COUNTY, TEXAS NO. 53

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 54

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 55

LUBBOCK COUNTY, TEXAS NO. 55

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

655 000 FEET

1680 000 FEET

(Joins sheet 49)

(Joins sheet 56)

(Joins sheet 54)

(Joins sheet 62)

1670 000 FEET

675 000 FEET

Woodrow

LUBBOCK SOUTH AIRFIELD

55

N

1 Mile

5000 Feet

Scale 1:20000

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 56

56

N

(Joins sheet 50)

700 000 FEET

680 000 FEET

(Joins sheet 55)

(Joins sheet 57)

670 000 FEET

680 000 FEET

(Joins sheet 63)

1 Mile 5000 Feet

0 0

Scale 1:20000

1/4 1 000

1/2 2 000

3/4 3 000

1 4 000

5 000

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 56

LUBBOCK COUNTY, TEXAS NO. 57

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 58

LUBBOCK COUNTY, TEXAS NO. 59

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

755 000 FEET

(Joins inset, sheet 46)

680 000 FEET

Yellow House

North Fork Double Mountain Fork Brazos River

LONG HOLLOW CANYON

Draw

(Joins sheet 58)

CROSBY COUNTY

670 000 FEET

(Joins upper right)

760 000 FEET

755 000 FEET

(Joins lower left)

665 000 FEET

(Joins sheet 65)

ATCHISON, TOPEKA AND SANTA FE

655 000 FEET

760 000 FEET

LYNN COUNTY

CROSBY COUNTY

GARZA COUNTY

59

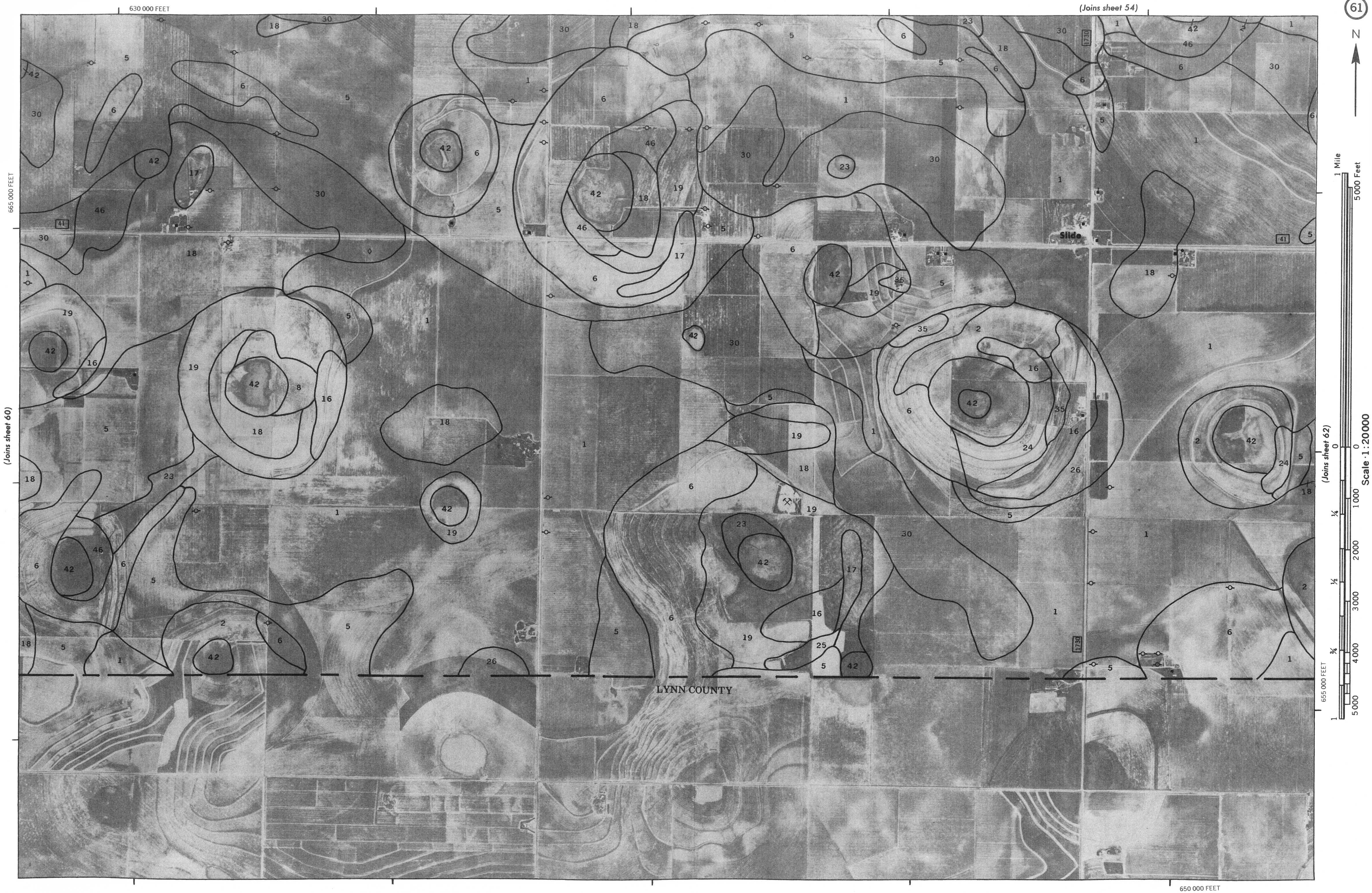
N

1 Mile

5000 Feet

Scale · 1 : 20000

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



LUBBOCK COUNTY, TEXAS NO. 61

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 62

62

N

(Joins sheet 55)

675 000 FEET

665 000 FEET

(Joins sheet 61)

1 Mile

5000 Feet

Scale 1:20000

655 000 FEET

LYNN COUNTY

(Joins sheet 63)

655 000 FEET

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 62

LUBBOCK COUNTY, TEXAS NO. 63

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

64

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 64

N

Scale · 1 : 20000

1 Mile 0 ½ 1

5000 Feet 0 1000 2000 3000 4000 5000

(Joins sheet 57)

(Joins sheet 63)

(Joins sheet 65)

LYNN COUNTY

725 000 FEET

665 000 FEET

655 000 FEET

705 000 FEET

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

LUBBOCK COUNTY, TEXAS NO. 64

LUBBOCK COUNTY, TEXAS — SHEET NUMBER 65

LUBBOCK COUNTY, TEXAS NO. 65

This map is compiled on 1975 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

730 000 FEET

665 000 FEET

650 000 FEET

750 000 FEET

(Joins sheet 64)

(Joins sheet 58)

(Joins inset, sheet 59)

SLATON

LYNN COUNTY

SANTA FE

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ATCHISON TOPEKA AND SANTA FE

65

N

1 Mile

5000 Feet

Scale 1:20000